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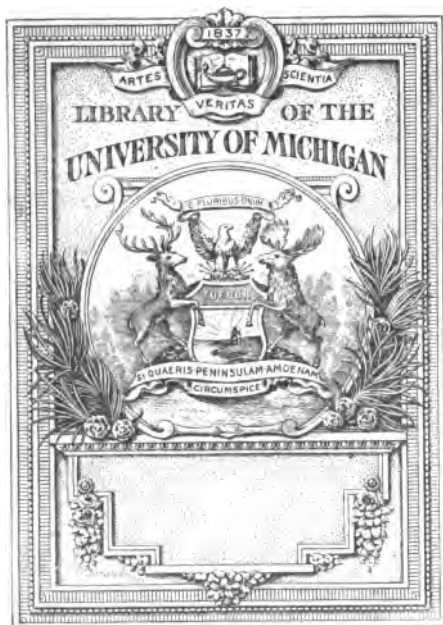
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**THOUGHTS OF A
CATHOLIC ANATOMIST**

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ARCHBISHOP OF BOSTON

January 26th, 1911

THOUGHTS OF A CATHOLIC ANATOMIST

BY

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"Credidi, propter quod locutus sum."

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PREFACE

IF I be not mistaken, there is more or less curiosity on the part of those outside of the Church to know what Catholics of education, especially those who themselves have worked in science, think in their own hearts of the dogmas of the Church on the one hand and of the assertions of modern science on the other. Are not Catholics guilty of dishonesty in appearing to subscribe to beliefs which they do not sincerely hold and which fail to accord with what is accepted by the public as science? The suspicion is perhaps not unnatural, especially on the part of those whose ideas of Catholics are distorted by the misrepresentations of centuries. It may be, too, that this suspicion is somewhat strengthened by the very natural unwillingness of men to wear their hearts upon their sleeves, to tell their most secret and solemn thoughts in the marketplace.

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It is often said by those outside of the Church that they cannot see how a Catholic can be a man of science, and conversely how a man of science can be a Catholic. Indeed, I fear there are many poorly instructed Catholics who are very much of the same opinion. It may be that it is my duty, on account of the position I have the honor to hold, to give to both of these classes such poor help as I can. It is many years since I began this book, which I have thrown aside again and again. Apart from the difficulty of finding time for the work, it seemed impossible to do it to my own satisfaction and to say anything which has not been better said. While I fear that the last objection still holds good, yet I hope that this little book may fall into hands which have not held the better ones. It is just possible that some of those who have been my pupils during the twenty-seven years of my professorship may be interested in the views as mine. Should that be the case, I am sure that I need not tell them that this discussion is meant above all to be an honest one.

The book bears the *imprimatur* of the

PREFACE

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Church. The nature of some of the topics discussed made it my bounden duty to apply for it; but I should have done so in any case, that there might be no question as to the orthodoxy of any of my statements.

January, 1911.

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**THOUGHTS OF A CATHOLIC
ANATOMIST**

INTRODUCTION

Synopsis.—Decline of religious belief; science the alleged cause. Relations of religion and science.

It is a truism to say that during the last fifty years there has been a great change in religious feeling throughout the community, excepting always the Catholic Church. Fifty years ago openly to deny God was to put one's self beyond the pale of respectability. Now, on the contrary, in many societies it is distinctly the fashion, and is affected as an evidence of true enlightenment. How much of this atheism is sincere, and how much merely the posing of "*le fanfaron des vices qu'il n'a pas*," is not easy to say. For my part I believe that the fanfaron is very much in evidence; but I admit that I may be prejudiced. It was not till I had reached middle age that I became convinced that there are those who are sincere in their

denial. I had read and heard denials enough, but I had not paid the deniers the compliment of believing them. In this I certainly was wrong. I now recognize as beyond doubt that there are those, and some of them men of great minds, who do not believe in God. None the less I still think that the dishonest deniers far outnumber the sincere ones. With the decline of faith we have at least got rid of the religious hypocrite. It is no longer necessary, nor even politic, to affect a virtue (that of piety) if one have it not. A new standard of distinction has been raised: it is to be truly liberal and enlightened. The Tartuffe of the day pursues a course diametrically opposed to that of his prototype. Still there is but too much evidence of the practical atheism of many, furnished by their lives and more particularly by their deaths. Perhaps we all know atheists who, in despite of all logic, lead respectable, pure and useful lives. Let us make much of them; for their children will show themselves more logical. They will join the increasing multitude of those who, knowing no Lawgiver, see no

reason to obey law. What does it matter to them if some other collection of protoplasmic cells suffers a little more or a little less? After all, can they be sure that it does suffer? So having run the gamut of pleasure with other men's money and other men's wives, they will not shrink from the quietus they can so easily make for themselves. They have got bravely over "the dread of something after death" and are acting accordingly. Hundreds are doing this to-day for every one who did it a generation ago. What will be the proportionate increase in the next generation is an interesting but difficult question.

When we ask what may be the cause of this change we are told that it is the advance of science, the decline of ecclesiastical influence, and perhaps above all the doctrine of evolution. It may be doubted whether other influences are not at work, but there is much in support of the theory that evolution, or what is represented as evolution, has a large share in the process. Those of us who are old enough to remember the Darwinian theory fighting its way step by

step cannot readily appreciate the state of mind of young men who have had it taught them from their school days. We have now the remarkable spectacle that, just when many scientific men are of accord that there is no part of the Darwinian system that is of any very great influence, and that as a whole the theory is not only unproved but impossible, the ignorant half-educated masses have acquired the idea that it is to be accepted as a fundamental fact. Moreover, it is not to them an academic question of biology, but, as the matter has been presented to them, it is a system: to-wit, the monistic system, of philosophy. Thus presented it undeniably is fatal, not only to all revealed religion, but to any system of morals founded on a supernatural basis.

Has science then taught us a new gospel? Has she given us a reason for life, a goal to strive for, a rule of conduct, a test of fitness? Has she explained away the doubts, filled the voids, soothed the anxieties which have distressed thinking and aspiring men? There are those who tell us that she has done all these things, if not perfectly, at least as far

as in the present state of progress is possible, and that she has more in store for those who come after us. Others, more conservative, will answer that although strictly speaking science has as yet done none of these things, she has at least made way for them by weeding out the old beliefs and accumulated superstitions which were smothering a new and better growth. At all events, it is certain that religious faith among all denominations, barring only the Catholic Church, has been rudely shaken, and that such faith as persists outside of the Church is remarkable chiefly for its vagueness.


I incline to sympathize with the sneer of a reviewer who, in the discussion of a book maintaining that there is nothing in religion contrary to science (or indeed in science contrary to religion), exclaims: "Nothing contrary!" as one would say: "Is that all? Have you nothing better than that?" It seems to me that many of the apologists for Christianity have made the mistake of fighting too much on the defensive. They have held their position, they have shown the weakness of their opponents; but, if I mis-

take not, they for the most part have stopped there, without going on to show that, as far as science has anything to say in the matter, its evidence is in support of religion, and that as a whole the Catholic's view of nature and of man is grander, more logical, and more satisfying than that of the monist.

It was, I believe, Professor C. Lloyd Morgan who protested against Brunetière's charge of bankruptcy against science, because when we seek for any noble motive of action, one might say for any beacon in a storm, we ask for something that it is not for science to give. But is it not the boast of infidel science that she, and she alone, has all that is worth having? Why was this claim made if it cannot be fulfilled? Most assuredly those who came at her call to receive from science what she knew she could not pay have the right to declare her bankrupt!

The mutual relation of religion and science is a vital question. Many hold that there can be no interference with science on the part of religion, nor with religion on the part

of science, because their spheres are entirely distinct, just as lines in two separate planes can by no possibility intersect one another. This is a staple argument, but is it correct and complete? Is it true that religion and science have nothing in common? Can a man honor the one and despise the other, and then honor the other and despise the one alternately? It is as if one should say: "I believe in medicine and I believe in law, but I keep them quite apart", forgetting that there are sanitary rules to be observed in studying law, and laws which may not be ignored in the practice of medicine. It were better to compare religion and science to two planes with a common line of intersection. If we imagine one of these planes to have some peculiar property that would diffuse itself through the other, provided they came into contact, the comparison is complete. The Catholic faith which pervades the plane we have called religion modifies the conditions of the plane we have called science. Thus there must be a difference in the grasp of nature of a Catholic and of an unbeliever. Although the former ac-




cepts scientific facts by reason alone, yet his confidence in what his reason perceives is confirmed by his faith. This being granted as self-evident, why bring in the word "Catholic"? I want to answer this question frankly, and, as nearly as I can, without offence to those of other denominations who share with me the belief in God. It is because the Catholic religion is based on unchangeable dogma, because its standpoint in essentials of faith is immovable, because it has the honor of being the particular object of the attacks of opponents. Finally, it is because so much has been written about the position of Catholics in regard to science that I wish above all to speak as a Catholic.

The great dogmas of religion are unchanged and unchangeable. As Catholics we are not only ready but proud to confess our belief in them. Beside these dogmas are doctrines never defined by the Church, which are so closely connected with what is of faith, and have been so constantly held, that it would be at least rash to question them. Together with these are other views which rest on no certain authority and may

give rise to difficulty from their apparent disagreement with scientific facts. Now the Church teaches that if a certain interpretation of Scripture implies what is contrary to established science, it is to be reëxamined; for truth cannot contradict truth. The Church solemnly and authoritatively proclaimed at the Council of the Vatican: "*Nulla unquam inter fidem et rationem vera dissensio esse potest*": "Never can there be a real conflict between faith and reason." In such cases the Church is wisely conservative. The burden of proof is on science, who must establish her claim.

Science, though in a lower sphere, has also her dogmas, doctrines, views and theories ranging from practical certainty, through every degree of probability down to mere speculation. From the very nature of things quite absolute certainty is not readily attainable. True science, therefore, demands that theories should not be given as facts, nor working hypotheses revered as laws. This is the plain course of sense and honesty. Unfortunately this is so often lost sight of that much has been palmed off on the pub-



lic as science which is but its poorest counterfeit, by raving fanatics, shrieking that religion must be made over to conform to some theoretical vagary, born yesterday to be forgotten to-morrow.

Certainly truth cannot contradict truth. More than that: it is reasonable to expect that truth in one sphere should strengthen truth in another so far as they have anything in common. All this is perfectly evident to the Catholic. He knows that when a doctrine bearing on science is defined by the Church as true (as for instance that the soul of man is a special creation), it is to him an additional safeguard against error, not a hindrance to research. But what is very unsatisfactory is that he cannot reasonably ask an unbelieving opponent to agree to it. The latter will reply: "You ask me to accept a criterion of certainty for which I have no respect; why should I do so?" He may continue that there is so much that is analogous in the mental processes of man and animals, to say nothing of the undoubted fact there is no essential difference in their bodies, that he prefers to believe

that there is no real difference between the souls. On my side I reply by offering psychological proofs that there is a radical difference, and I know that the arguments are sound; but my confidence in them is immensely strengthened by the Church's decision.

The acceptance of supernatural religion is something more than the result of an act of deliberate reason. It is an act of faith, which owes its origin to a supernatural gift of God, by which the will accepts what is revealed to the mind. For many reasons I should have been glad to leave faith out of the discussion. One is that it takes us into the realm of theological science, which is far above me; another that in appearance at least it adds greatly to the difficulties of my contention, and finally because it is one of those subjects concerning which argument seems futile. But it may not be shirked, because it is an essential part of the discussion. I have, moreover, frankly accepted the supernatural and may not draw back. According to the catechism, the supernatural gift of faith is imparted with baptism and

is given to such unbaptized persons as God pleases. How comes it, one often asks, that certain men see all the reasons for religion, acknowledge the force of the arguments, and yet do not yield assent? One is tempted to say that it is from pride, or obstinacy, or the dread of the consequences. All these may indeed play their part; but there is something more. There seems to be a true inability on the part of the will to accept the logical consequences of what the reason admits. It is as if one should show a man two objects in one hand and two in another, saying that there are four in all, and he should reply: "It may be so, but I cannot be sure of it." The fact is that, faith being a gift to which human nature has no inherent right, God is not bound in justice to give it to anyone. If He gives it to some, no wrong is done to those who do not receive it. This argument, sound as I believe it to be, carries very little weight with opponents. One cause is that they are influenced by emotion rather than by reason; but their emotion is a kindly one with which all must sympathize. After all, free gift as

faith is, we Catholics believe that God gives it to those who sincerely wish for it and earnestly strive for it, provided always that they do not postpone this till too late. A man who refuses a great favor cannot complain if the offer be not repeated. St. Jerome was quoted by the Council of Trent as follows: "God does not demand the impossible, but by His holy precepts He admonishes thee to do what thou canst and to ask for what thou canst not; and He aids thee that thou mayst be able." Thus the Church teaches that God stands ready to help those who need Him.

That we must be misunderstood is inevitable. We must bear it as we may, consoling ourselves by remembering that the man of normal vision must seem very imaginative to the color-blind. The Catholic rejoices by his faith not only in a grander view of creation but in one far more in accord with true science than the atheistic or pantheistic one offered us by the so-called science of the day. Let me conclude with Brunetière:¹

¹ Brunetière. *Les raisons actuelles de croire*. In *Discours de Combat*. 1900.

“Fides est argumentum rerum non apparentium. Et ce n'est pas à dire pour cela qu'elle s'oppose à la raison! Non, elle ne s'y oppose point; elle nous introduit seulement dans une région plus qu'humaine, où la raison, étant tout humaine, n'a point d'accès; elle nous donne des lumières qui ne sont point de la raison; elle complète la raison, elle la continue, elle l'achève, et, si je l'ose dire, elle la couronne.”

I

THOUGHT OF THE DAY

Synopsis.—Does evolution leave us a God? Parallelism of the French Revolution and modern science. Professor His' exposure of Hæckel. The *sans-culottes* of science. Unwillingness of leaders of science to tell the whole truth. Writings of prominent non-Catholics: Mallock, Osler, Goldwin Smith (confusion of imagination and reason), C. Lloyd Morgan, William James.

THE decline in faith consequent upon the progress of evolution, or merely contemporaneous with it, as the case may be, has deeply scarred the community at large. In spite of the growing number of Catholics, and of the increasing numbers of those of education, it is to be owned that we Catholics influence public opinion very little. It may be that man for man, owing to the spread of the Church, there are more believers than there were in this community fifty years ago; but they are not the ones that have the ear of the public. They do not form the reading, writing, speechifying

set that is prominent in magazines, in editorials, in after-dinner, and in Commencement speeches. This set either has lost its faith completely or (what I believe to be true of more than a few) considers it better policy to ignore it. Thus all the utterances of these formers of public opinion would give us to understand that science has altogether disposed of religion. And yet deep down in the mind of the community a remnant of faith lingers. The majority still believe in a God and in immortality. The community still feels that the words "right" and "wrong" have a meaning, thereby acknowledging free will and accountability. Yet the popular notion of science has somehow implied that these ideas are but superstitions, remnants of mental states of past generations on which science has not shed its beneficent ray, lighting up every corner of the universe and proving that there is no place in it for God. "Does evolution leave us a God, such a God as a Christian can earnestly believe in?" wrote Professor Bruce,¹

¹ The Message of Israel, *The Contemporary Review*, July, 1894.

and many an anxious student has echoed the question.

The parallelism between the lines of thought of the French Revolution, as well as the personnel of that movement on the one hand and those of modern science on the other, is very suggestive. For my part I believe that even without the appearance of Darwin's theory a state of thought not very different from the present one would somehow have come to pass; but beyond question this doctrine, which, though not in itself atheistic, lends itself so readily to first the ignoring, and then the denying of a Creator, accelerated the movement to an incalculable degree. Among the characters of the revolution we meet all kinds of company. There are the honest men anxious for reform, the protestors against what they conceived to be religious oppression, the dreamy idealists without definite plan, the ranting orators of the "mountain," fanatics and demagogues at once, the wily ones who make a living from the more or less sincere promulgation of revolutionary doctrines and who find legalized plunder very profitable,

the army of those who for fear or for favor prefer to be on the winning side and follow the fashionable doctrines without an examination which most of them are incompetent to make, and finally the mob of the *sans-culottes* rejoicing in the overthrow of law, order and decency.

In comparing the followers of modern science with these classes there is need of much caution. First of all, we may rejoice that among men of science the number of sincere searchers after truth is relatively much larger than that of those of the revolution actuated by a sincere wish for reform. The tyranny of the *Zeitgeist* in the matter of evolution is overwhelming to a degree of which outsiders have no idea; not only does it influence (as I must admit that it does in my own case) our manners of thinking, but there is the oppression as in the days of the "terror". How very few of the leaders of science dare tell the truth concerning their own state of mind! How many feel themselves forced in public to do a lip service to a cult they do not believe in! As Professor T. H. Morgan intimates, it is only

too true that many of these who would on no account be guilty of an act which they recognize as dishonest, nevertheless speak and write habitually as if evolution were an absolute certainty as well established as the law of gravitation. But this cringing to public opinion being admitted and deplored (for should not the true scientists be the formers of opinion instead of its sycophants?), that there is a large body of honest workers is a fact to glory in: and this glory is above all that of England and America. On the Continent, where there is so widespread and bitter an antichristian movement directed by the secret influence of Masonry, there is no doubt that the number of atheistic professors is relatively much greater than elsewhere; and I fear there is very little doubt that false science is being exploited for political ends. It is not for nothing that Europe is flooded with extraordinarily cheap editions of Hæckel.

There is little trouble in finding the prototypes of Hæckel and others of his class among the orators of the mountain, violent, reckless and unscrupulous. I should be

glad to pass this man by without more words, but for the very reason that he is looked upon as a leader and a prophet, not by the ignorant alone, but by many who should know better. For their enlightenment it is necessary to show what his word is worth. This was done as long ago as 1874 by the late Professor Wilhelm His, the great embryologist and one of the most respected leaders of science.

In a book entitled *Unser Körperform und das physiologische Problem ihrer Entstehung* His shows how Hæckel in the first edition of *natürliche Schöpfungsgeschichte*, wishing to show the likeness of embryos of different species, gives on page 242 figures of the egg, one hundred times magnified, of man, the ape and the dog; and on page 248 also three figures of the embryo of the dog, of the chick, and of the turtle. His points out quite amusingly certain features of resemblance in the three figures of these two series. Not only are these figures identical in outline but in non-essentials also. Thus it happens that the granules in a certain part of the dog's egg are coarser than in the

other parts, and there is an absolutely identical arrangement in the eggs of man and of the ape. Very remarkably the first vertebra in the embryos of dog, chick and turtle is a little more rounded on the right side, and the ninth a trifle narrower than the others. In short, to make the pretended similarity as striking as possible, Hæckel used in two instances the same figure and gave it three different names. This fraud was pointed out by Professor Rüttimeyer in *Archiv für Anthropologie*, Bd. III, s. 301. Professor His remarks that one would expect a retraction and excuse for the mistake; but no. "Instead of this, Hæckel in the preface of his later editions heaped heavy insults on Professor Rüttimeyer equally untrue in their substance as dishonorable in their form" (p. 169). He however saw fit to omit the duplicates. But the exposure did him no good. Professor His tells us that in the fifth edition of the same work of Hæckel's there is a copy from Bischoff of the figure of an embryo of a dog, and from Ecker of one of a human embryo, both assumed to be of four weeks. He points out certain

peculiarities of these "copies" well worthy of notice. "Or," he asks, "is it through a mistake of the lithographer that in Hæckel's dog embryo precisely the frontal part of the head is three and one-half millimetres longer than in Bischoff's, but in the human embryo the forehead is shortened by two millimetres, and at the same time, by the pushing forward of the eye, made narrower by fully five millimetres?" In short, what purported to be copies of figures published by leading authorities and respectable men were falsifications made to show a similarity which does not exist between the embryos of man and dog. He then points out other false dealings by Hæckel in the matter of illustrations, some of which he declares to have been invented (*erfunden*), and remarks very justly that his play with facts is far more dangerous than his play with words, inasmuch as it requires an expert to denounce it. He charges that Hæckel well knew the influence that he exercised on a large circle. "Let then others honor Hæckel as an efficient and reckless party leader; according to my judgment he has

forfeited through his methods of fighting even the right to be counted as an equal in the company of serious investigators" (p. 171). There is only to add that Hæckel, in spite of plenty of subsequent exposures, has not reformed his ways.¹

Surely Professor His deserves great praise for his course. How different the world would be if political leaders would give evidence against the bribery in their own party, if capitalists who add to their fortunes by wrecking railroads (if they cannot be brought into court) should at least be expelled from the clubs of gentlemen, if the labor unions would be the first to denounce those among them who murder men who prefer to work! Perhaps one reason why we do not see more of this is that such services to the community are disregarded. Hæckel has flourished in spite of His. He was pres-

¹ If anyone would know what the late Alexander Agassiz, whom we all honor as a scholar and a gentleman, thought of Hæckel, let him consult Agassiz' report on the expedition of the "Albatross" in the Bulletin of the Museum of Comparative Zoölogy at Harvard College, Vol. XXIII, 1892, p. 32 to p. 40. His tone is not that of one arguing with an equal, but of one exposing a knave.

ent at the Darwin Memorial Meeting at the University of Cambridge. Still we can hope and believe that Professor His' work and example will not be lost.

From Hæckel we pass to his disciples, who may be likened to the camp followers in the army of science. Needless to say, they are not more scrupulous than their master. One of our greatest curses has been the atheistic popular lecturer, the purveyor of sham science on the one hand and the hater of religion on the other. He spreads abroad the wildest theories as established facts, clamoring that the whole social fabric, religion and all, should be remodelled to suit the new revelation. He does not know whether there is a God or not; but he does know that man came from an ape. There is no certainty that our senses tell us the truth, yet there is no knowledge but from observation. An idea is nothing but a glorified sensation, idiocy is a reversion, crime a disease, free will a delusion, religion an emotion. The mischief that such men do is great indeed. The young man sees the popular lecturer praised and flattered. He

is dazzled by his plausibility and brilliancy. The plain fact that his hero is but a quack does not occur to him.

Without very definite separation from the preceding class come finally the *sans-culottes* of science who, for the most part without any pretence to knowledge of their own, accept all that the orators of the mountain tell them and pass it on with their own deductions as to conduct and morality, unscrupulous in their assertions and scurrilous in their manner. We hear enough from them about the oppression of science by the Church; but were I asked where is the one who has done the most in the last half-century to degrade science, and is, therefore, her greatest enemy, I should look towards Jena.

It may seem that I am not doing justice to the serious men of science, Catholic and non-Catholic alike. It is far from my intention to slight them. Of the Catholics we may say that Pasteur's merits and services to humanity were so great that he could not be ignored. Mendel at last is getting recognition, but only from the men of sound

science. Of the Reverend Eric Wasmann, S. J., the public knows very little, and perhaps even less of the number of distinguished Catholic men of science of the last century. Dr. J. J. Walsh has done a good work in bringing them before us; but unfortunately their influence is ignored and very different men are the idols of the populace. Among non-Catholics the name of Bateson presents itself at once as an honest searcher for truth, to whom the world of science owes much; but how many of the outsiders would give him the place he deserves?

When, therefore, I dedicate this chapter to the thought of the day (in the matter of science being of course understood) I necessarily am forced to disregard what is best and confine myself to those in the limelight. The point I am trying to emphasize is that sound science is not the science that is in the mind of the public. It would really seem as if there were an occult power at work to support those whose influence is against God, religion and decency, by the diffusion of sham science. It is preached so persistently and ubiquitously that even such as I

forget to use its full name, and dropping the "sham" find ourselves giving the title of "science" to what we despise.

The work of sham science in first deceiving and then demoralizing the population has been well done. We find men and women of all degrees outside of the Catholic Church lamenting that all their foundations of belief are gone and that science is the torrent that has swept them away. How complete is the deception of which even men of high abilities are the victims will be shown by the writings of educated non-Catholics of more or less reputation during the last generation as men of science or as general critics. It is instructive if disheartening reading. A very striking feature is the implied, sometimes the frankly expressed, admission that a logical answer to their perplexities is impossible; yet they will not turn to the Church which alone can furnish it.

Mallock, in his "Religion as a Credible Doctrine," admits this perfectly fairly. Near the beginning he tells us that what is needed is "an intellectual accountant" whose pri-

mary task is to reduce the statements of the two sides to such a form that the arguments can be easily grasped and that the reader may see clearly what on either side is absolutely contradictory to the claims of the other. With a guilelessness with which few would have credited the author of "Positivism on an Island" he chooses Hæckel as the representative of "science" (under the circumstances we must really be excused for the quotation marks). Had he chosen a more trustworthy guide, he hardly would have given us such an absurd crudity as the following: "As the embryo of the baby recapitulates the evolution of man as an organism, so does the progress of the baby from an unthinking to a thinking being, recapitulate the evolution of the specifically human intellect." None the less he sums up fairly enough: "The whole point, then, at issue between the dualist who asserts religion and the monist who denies it, so far as man is concerned, is this—not whether organic life contains in it any element which is not present in the substance of the inorganic universe; but whether human life

contains in it certain elements which, in other organic life, so far as we can see, are absent; whether the life of man, unlike life generally, survives the life of the body; and whether, utterly unlike any other phenomenon known to us, the will of man is unfettered by a causation that is otherwise universal" (p. 46).

Such is the problem, but what is Mallock's solution? Not to find out which of the two sides is right, but "to discover a means by which we may reasonably assent to both" (!) (p. 219). He proves clearly enough that man cannot get along without religion, that the common-sense of mankind demands the recognition of free-will and of certain ethical principles; but he will not admit that these in our present state of knowledge are reconcilable with science, hence both of two contradictories must be accepted, a course surely in accord with the practice of neither religion nor science.

But to take a man of higher scientific attainments let us look at Osler's Ingersoll Lecture on Immortality. Even he falls into the error of putting science and religion in

antithesis, which he does all the more easily by making religion an emotion and as such useless to men of science. He further labors under the delusion that during the last fifty years science has actually demonstrated something contrary to the principles of religious faith.

The state of mind of the late Goldwin Smith always impressed me as most pathetic. On the one hand was the wish to believe, on the other a bogey which he conceived to be science forbidding him to do so. His was not one of the minds that are content to accept Mallock's solution of believing both of two contradictories, and yet for absolute incompatibility with one another his views were very little better. All this is illustrated in his paper on the Immortality of the Soul in the *North American Review* of May, 1904. He begins by telling us that "Immortality, if taken to mean conscious existence, is inconceivable. The attempt to conceive it ends in mental vertigo. The term is too familiar to be supplanted, but it must be taken to mean no more than continuance of existence after death." Truly

a new and original view of immortality! And why is a non-conscious immortality easier to conceive of than a conscious one? It is the old story of confusing imagination and reason. Who can form a mental image of truth, or of an atom? Is not the effort conducive to mental vertigo?¹ The follow-

¹ It is an error to assume that we cannot understand what we cannot imagine. The explanation in brief is this: that while imagination serves for forming what may be called the substratum of ideas, the latter are in a higher sphere. They belong to reason while the imagination belongs to the body, being a function of the brain, like sight or hearing. It is not true, though we have often been told that it is, that the only idea we can form of God is derived from magnifying our own image. Let us distinguish between reason and imagination.

As has been pointed out long before now, we can grasp perfectly well the idea of a mathematical line, length without breadth, or of a triangle as a plane inclosed by three straight lines; but we can imagine neither the one nor the other. When we try to imagine a line we can picture to ourselves a white line on a black ground or a black line on a white ground, but in as much as we seem to perceive the line the image is a false one, for we could not see a mathematical line because it has no breadth. In the same way if we try for an image of a three-sided figure it always has a certain shape. It is a triangle; but it is a particular triangle. All the angles may be acute or only two of them; all the sides may be equal or all unequal. Thus while we can imagine an indefinite number of triangles we cannot imagine a figure

ing passage is absolutely startling, giving as it does so striking an illustration both of the sham science forced not only upon the ignorant but upon the educated, and of the wonderful credulity with which they swallow it. "It is impossible since Darwin's discoveries to uphold anything dependent on the belief that man is a creature apart from other animals. It has been overwhelmingly demonstrated that man's bodily frame and his soul as its outcome and perfection, has been produced by a process of evolution from lower forms of animal, it may be of vegetable life." "Overwhelmingly demonstrated" is good. One might ask how the soul, if it is the outcome of the body, can be its perfection; but let that pass. We are given to understand that science and science alone has brought the solution to the problems which vex mankind. But presently our author turns round and demolishes what he

to which every triangle must correspond; and yet we can understand a triangle. This proves that imagination is the servant of reason, which is far above it. Thus we can grasp the idea of a perfect and infinite Being, though we can by no possibility make a corresponding image in our imagination.—T. D.

has so lightly asserted, to-wit that there is no essential difference between man and animals. "Darwin," he says, "assumes that conscience is merely the individual index of general opinion. Surely in the case of religious men and nations it is something more. It has sustained the martyr against the overwhelming preponderance of public opinion, and is constantly sustaining men of independent mind against the opinion of the hour." He points out very well the difference between the human sense of responsibility and that which may exist in animals: "A hunter that has refused a leap or a pointer that has run into game fears his master's wrath, but not an injury to his moral being." More than this: he stands for the freedom of the will absolutely, with a clearness that is utterly at variance with the monistic doctrines which he apparently has felt called upon to accept. He declares: "But unless our nature lies to us we have liberty of choice with responsibility attached to it; and if our nature has lied to us, philosophy may as well spare its pains." It is good to hear such unequivocal testimony for

the truth; but how does this fit in with what has gone before?

Far more difficult is the analysis of the letters that Professor C. Lloyd Morgan¹ wrote on Hæckel's "Riddle of the Universe." Occasionally he seems to be in the ether, occasionally in the mire. He has a puzzling conception of science as the study of a succession of states, absolutely empirical, without consideration of cause or end. Then he has a system of metaphysics to correct the deficiencies of science; only we are told that these two are distinct and yet somehow we have need of both for an harmonious system. Science according to him is distinctly materialistic; yet he believes in science and is far above materialism. The riddle of the universe is not to be answered in terms of science; yet science is good. When we come to a First Cause we are more and more puzzled. Professor Morgan objects to a God, who at times intervenes, and as an alternative accepts a system of pantheism of which he himself fully recognizes the difficulties. He sees the impossibility of distinguishing

¹ *The Contemporary Review*, June, 1904.

one's neighbor from one's self, and both from God, which of course makes nonsense of everything. Do we not know that we are not God, nor our neighbor, but just ourselves? Professor Morgan owns frankly that he cannot resolve the difficulties. After this hopeless confusion of God and man, of the ego and the non-ego, it does us no good to be told that there is a pervading purpose and that the underlying Spiritual Cause is throughout purposeful. Have we not had cause and effect hopelessly jumbled?

What is most striking in this kind of paper is the longing for something above materialism, the sincere wish to hold on to old beliefs and the despairing failure to find any solid reason for even a hope of being able to do so. William James stated the present condition very correctly in his "Pluralistic Universe" (p. 24). "Dualistic theism is professed as firmly as ever at all Catholic seats of learning, whereas it has of late years tended to disappear at our British and American universities, and to be replaced by a monistic pantheism more or less disguised."

Professor James¹ is very different from all the preceding with his originality, ability and honesty, marred, if I may say so, by a certain perversity. He declares that "the theological machinery that spoke so livingly to our ancestors . . . sounds as odd to most of us as if it were some outlandish savage religion" (p. 29). He reasons, invoking logic, to prove that there is only a finite God, finally to throw logic to the winds. Referring to questions connected with the soul he exclaims: "Well, what must we do now in this tragic predicament? For my part, I have finally found myself compelled *to give up the logic*, fairly, squarely and irrevocably. . . . Reality, life, experience, concreteness, immediacy, use what word you will, exceeds our logic, overflows and surrounds it" (p. 22). Elsewhere he says: "I saw that I must either forswear that 'psychology without a soul' to which my whole psychological and kantian education has committed me,—I must in short bring back

¹ These lines on Professor James, who was a valued friend, were written but a short time before his lamented death. I am confident that he would not have objected to them, and so I leave them as they were written.

distinct spiritual agents to know the mental states, now singly and now in combination, in a word bring back scholasticism and common-sense—or else I must squarely confess the solution of the problem impossible, and then either give up my intellectualist logic, the logic of identity, and adopt some higher (or lower) form of rationality, or finally, face the fact that life is logically irrational. . . . Those of us who are scholastic-minded, or simply common-sense-minded, will smile at the elaborate groans of my parturient mountain resulting in nothing but this mouse” (p. 208). The thing, however, is too sad to smile at, and the result is not a mouse but a monster who has devoured reason and common-sense and offers us instead pragmatism. Read James’ “Faith Ladder,” of which he himself says: “Not one step is logical, yet it is the way in which monists and pluralists alike espouse and hold fast to their visions. It is life exceeding logic, it is the practical reason for which theoretic reason finds arguments after the conclusion is once there.” But one might ask, if to be a monist one must give up common-sense,

why be a monist at all? He seems to consider monism a creed its professors are bound in conscience to defend, even as Catholics owe allegiance to the Church.

This whole discussion would be very amusing were it not so sad. The atmosphere is one of uncertainty, or rather of ignorance, for there is no starting point. The Catholic turns from it doubly thankful for the gift of faith.

II

THEORIES OF EVOLUTION

Synopsis.—Tyranny of the Zeitgeist. T. H. Morgan's destruction of Darwinism, Weismannism, Lamarkism. Mivart and Argyl, De Vries, Mendel. Wasmann endorses evolution, but insists upon internal causes. A grand line of descent a dream. The author's belief in a modified evolution. The radical view. Papers at the Darwin Memorial. The ignorance of the educated.

THE fiftieth anniversary of the appearance of Darwin's book on the Origin of Species was celebrated at the University of Cambridge in 1909. Although only the ignorant (whose name, however, is "legion") confound Darwinism and evolution, yet it must be admitted that the appearance of this book was the beginning of the general acceptance of evolution as the working hypothesis. Its sway is now practically universal, although the acceptance of the theory is by no means the same in all quarters. To some it is a law as certain as that of gravitation, to

others it is a highly probable hypothesis which may be accepted as the working one, to others it is to be accepted with certain limitations, notably as to the origin of the soul of man. Few indeed deny it absolutely and unqualifiedly. Such is the tyranny of the Zeitgeist. Moreover, it must be admitted that those whose duty is to teach the young the plain truth concerning the facts of science have by no means always acted in good faith. By this I do not refer to the notorious falsifiers, but to men of real merit. Much credit is due to Professor Thomas Hunt Morgan for saying this plainly in his preface to "Evolution and Adaptation." His criticism applies indeed more particularly to Darwinism than to evolution, but it is true enough of both. He writes: "But I venture to prophesy that if anyone will undertake to question modern zoölogists and botanists concerning their relation to the Darwinian theory, he will find that, while professing *in a general way* to hold this theory, most biologists have many reservations and doubts which they either keep to themselves or, at any rate, do not

allow to interfere either with the teaching of the Darwinian doctrine or with the applications which they make of it in their writings. The claim of the opponents of the theory that Darwinism has become a dogma contains more truth than the nominal followers of the school find pleasant to hear."

It is very far from my intention to discuss the various theories of evolution in detail. It has been done sufficiently by those whose zoölogical knowledge is far greater than mine. I wish to refer my readers particularly to this work of Morgan's which is an admirable specimen of destructive criticism of Darwinism, of Weismann's modification of it, and of Lamarkism. To many it will be the more convincing that there is no trace of any religious tendency nor of any appreciation of the supernatural. It simply points out the inadequacy of the evidence. The most that can be said of Darwinism is said in direct continuation of the passage in the preface already quoted: "But let us not, therefore, too hastily conclude that Darwin's theory is without value in relation to one side of the problem of adaptation; for while

we can profitably reject, as I believe, much of the theory of natural selection, and more especially the idea that adaptations have arisen for their usefulness, yet the fact that living things must be adapted more or less well to their environment in order to remain in existence may, after all, account for the widespread *occurrence* of adaptation in plants and animals." One is at a loss to see, however, what comfort Darwinians can gather from this concession.

Beyond question just at the time when the uneducated are prating about the triumph of Darwinism it is fast losing caste among men of science. After all what has ever been established? What evidence have we of the *gradual* passing of one species into another? What has become of the intermediate forms, not indeed of those between any two given species, but of those between the hosts of species which must have in turn risen from lower and given origin to higher ones? Rudimentary and useless structures have been one of the strong points of Darwinism; but what do they show? First, that there are certain strong resemblances, presumably de-

pendent on unity of plan, between different species, indeed different orders, and even different classes of animals; second, that there are beyond any question structures that are useless to the individual. Formerly those were quoted as inheritances, degenerate representatives of structures of past usefulness, and in many cases this may be true; but Osborn tells us that his palæontological studies show that rudimentary structures, horns for instance, appear in species which could not have inherited them; but which are themselves the ancestors of those who are to show these same structures in greater development. Nothing could be more fatal than this, not only to Darwinism, but to any system of purposeless evolution. Hybrids are as sterile as they ever were. New species have failed to materialize. Artificial variations (unless fixed by the crossing of Mendel's "dominants" with dominants or of "regressives" with regressives, of which Darwin knew nothing) still tend to revert to original conditions. Sexual selection, the theory according to which the best equipped males carry off the females from their inferior

neighbors, has not proved its claims. It is not certain that surviving species are always the best adapted to their surroundings. The theory has been most productive of loose reasoning. Morgan, referring to the Darwinian school, says very justly: "To imagine that a certain organ is useful to its possessor, and to account for its origin because of the imagined benefit conferred, is the general procedure of the followers of this school" (p. 453). It has given rise, however, to worse than loose reasoning, for conclusions destructive of all morality founded on quite imaginary premises have been offered to the unwary.

One of the various offshoots from the Darwinian theory is that of Weismann, which ascended like a rocket to come down like the stick, though its inventor and some few disciples still maintain it. The following summary of the theory is from Weismann's paper read in 1909 at the Darwinian Memorial. "With others I regard the minimal amount of substance which is contained within the nucleus of the germ-cells, in the form of rods, bands or granules, as the *germ-*

substance or *germ-plasm*, and I call the individual granules *ids*. There is always a multiplicity of such *ids* present in the nucleus, either occurring individually, or united in the form of rods and bands (chromosomes). Each *id* contains the primary constituents of a *whole* individual, so that several *ids* are concerned in the development of a new individual." The reader will please to note that this *id* is a microscopic granule. It would be interesting to know how Weismann learned its composition, which he details to us as follows: "In every complex structure thousands of primary constituents must go to make up a single *id*; these I call *determinants*, and I mean by this name very small individual particles, far beyond the limits of microscopic visibility, vital units which feed, grow and multiply by division. These determinants control the parts of the developing embryo,—in what manner need not here concern us. The determinants differ among themselves, those of a muscle are differently constituted from those of a nerve-cell or a glandular cell, etc., and each determinant is in its turn made up of minute

vital units, which I call *biophors* or the bearers of life." Considering that these determinants, to say nothing of the biophors, are "far below the limits of microscopic visibility," it is a little hard to understand how their existence was determined. They could not be seen, still less could they be isolated or subjected to chemical analysis. But all this is a trifle to Weismann, who goes on to explain that these determinants vary like everything else: "They may vary qualitatively if the elements of which they are composed vary, they . . . and their variations may give rise to *corresponding* variations of the organ, cell, or cell-group which they determine." He then explains that if a determinant gets more than its share of nutrition it will grow beyond its fellows, and later when the *id*, of which it is a part, becomes an embryo, the cell from the determinant in question will be a very large one: an instance of hereditary individual variation. And this is what is palmed off upon us for science! As Morgan says: "Invisible germs whose sole functions are those which Weismann's imagination bestows upon them,

are brought forward as though they could supply the deficiencies of Darwin's theory." There is, however, a still graver charge against Weismann than that of simple fabrication of hypotheses. It is that of unwillingness to admit the truth; and is founded on his own statements. In a controversy with Herbert Spencer nearly a score of years ago as to the sufficiency of the theory of selection, which Weismann was defending, he wrote: ". . . we must assume natural selection to be the principle of the explanation of the metamorphoses, because all other apparent principles of explanation fail us, and it is inconceivable that there should yet be another capable of explaining the adaptation of organisms *without assuming the help of a principle of design*."¹ There it is in all its cynical brutality! In another place he tells us that we must accept selection "because the phenomena of evolution and adaptation must have a natural basis, and because it is the only possible explanation of them."

¹ *The Contemporary Review*, September, 1893, p. 328.
(Italics Weismann's.)

Thus it appears that neither reason nor logic nor, indeed, science itself counts for much; what is essential is to have an atheistic solution. This may be magnificent, but is it war? Further one may ask, what place has the avower of such views among men of science? Is he even of a higher class than Hæckel? What concerns us most, however, at this point of the discussion is the admission of one of the most stalwart defenders of natural selection that it cannot be proved but that it must be accepted to escape from the supernatural. That Weismann still adheres to these views is evident as he refers in a footnote in the Darwinian Memorial Volume to this discussion.

So much then for Darwinism pure and simple as well as with Weismann's elaborations. In our disappointment let us follow the example of more than a few leading men of science and see what Lamarck can offer us. Indeed I think that most of the non-Catholic men of science have a strong leaning in this direction. The response of the organism to the demands on special parts, by which these develop in structure and grow

more acute in function, as well as the wasting and degeneration caused by the lack of use, are very strong points which appeal to our imagination. To be sure Lamarck believed in spontaneous generation (that bubble pricked by Pasteur), but I am at a loss to see that this is in any way essential to the theory. On the other hand the want of proof of the inheritance of acquired characters is very serious. Theoretically they are transmissible, but in point of fact they are not transmitted. Attractive as the theory is in many respects, and vastly superior as it is to Darwinism, it cannot be considered as established, nor even as probable as a whole.

Professor H. F. Osborn¹ concluded as follows an address on the inheritance of acquired variations before the Society of Naturalists: "It follows as an unprejudiced conclusion from our present evidence that upon Weismann's principle we can explain inheritance but not evolution, while with Lamarck's principle and Darwin's selection principle we can explain evolution, but not,

¹ *American Naturalist*, Vol. XXV, 1891, p. 391.

at present, inheritance. Disprove Lamarck's principle and we must assume that there is some third factor in evolution of which we are ignorant."

Very worthy of serious consideration is the theory of changes by sudden leaps advocated by Mivart and the late Duke of Argyll, and in old times by St. Hilaire. It has since become known as the mutation theory of De Vries. According to Osborn, a very competent critic, De Vries has demonstrated the law of *saltation*. Osborn continues:¹ "That saltation is the constant phenomenon in nature, a *vera causa* of evolution, no one can longer deny. Bateson shows that it harmonizes with Mendel's conceptions of heredity, and it may be regarded as *par excellence* the contribution of the experimental method." It is to this theory that I myself incline very strongly, always with certain reservations and limitations, of which more hereafter. It seems that this is an effort to offer a scientific theory of evolution that shall be free from the objections which over-

¹ The Present Problems of Evolution, *The Popular Science Monthly*, January, 1905.

whelm Darwinism and Lamarkism. It implies vitalism, or the existence of a something in the organism which directs its growth both under normal and unusual circumstances, allowing it to adapt itself to changed conditions. It appeals to those who would escape as far as possible from unlimited special creations, feeling that it is a grander idea of God's work to believe that He set the machinery in motion and lets it go on according to nature's laws, which He had established. I suspect that this view savors a good deal of the anthropomorphism which the radicals of science rail against while they themselves are under its sway. Is it more difficult for the Almighty to make untold billions of creations than a single one? Most assuredly it cannot be so, and, therefore, we are judging God according to human ideals. On the other hand it is an axiom that we are not to assume supernatural interpositions which are not essential. If I mistake not this theory has a large following among Catholic men of science.

Head and shoulders above most workers

in evolution stands Abbot Mendel, who, trusting not to theory but to experiment, discovered a law, which has stood the test, concerning the working of variation through inheritance. But I must confess that valuable as this law has proved itself, I am at a loss to see that it has taught us anything of the formation of new species. It opens a most hopeful line of inquiry; but of the passing of one species into another it has as yet told us nothing.

The opinion of Rev. Eric Wasmann, S. J., whose studies on ants, wasps, and bees have placed him high among scientists is well worth quoting in this connection. He is convinced that the doctrine of evolution is not at variance with the Christian theory of life, and in no other way can he account for certain facts. The interest of the following quotation must be the excuse for its length.¹

“I wish to draw your attention to the fact that accommodation to the life of ants

¹ The Berlin Discussion of the Problem of Evolution, p. 13. The discussion was in 1907. The book was published in 1909.

and white ants or termites has in all probability led to the formation of *new species*, *genera*, and *families* among their guests, which belong to very various families and orders of insects. In many cases (*Thaumatoxena*) the characteristic marks have been so completely altered by accommodation that it is scarcely possible for us to determine to which order of insects this strange creature belongs. In other cases (*Termitomyia*) the whole development of the individual is modified in such a way that it resembles that of a viviparous mammal rather than that of a fly. The oft-repeated assertion of the upholders of the theory of permanence, that variation by way of accommodation only produces abnormal forms within the species, is thus seen to be false.

“What conclusions are we to draw from these considerations? If we carefully study the phenomena, which have just been presented to us, we must acknowledge that only the theory of evolution can explain to us how these interesting forms came into being. We cannot supply a scientific explanation by merely declaring that these

strange little creatures, such, for instance, as the Mimeciton or ant-ape, were created by God expressly for this or that variety of ant. *The principle of the theory of evolution is the only one which supplies us with a natural explanation of these phenomena, and therefore we accept it. But to what extent are we to accept it? Just as far as its application is supported by actual proofs.*" Surely this is the language of sane science. What a contrast to Weismann's!

Moreover, though recognizing the interior causes of evolution as the essential ones, he would not totally reject Darwinism. "My own experience," he says (p. 42), "gained in the course of research work in my special department, shows natural selection to be indispensable as a subsidiary factor, but only a factor—the *interior causes of evolution* remain always the chief point to consider, for they produce the beneficial modifications, and so are of greater importance than external circumstances, for these only eliminate the modifications which are not beneficial in the struggle for existence." In view of this acceptance of evolution Father Wasmann's

conclusions are the more important, and, at the risk of over-quotation, deserve to be given in his own words: "But the higher we ascend in the systematic categories, and the more closely we approach the great chief types of the animal world, the scantier becomes the evidence; in fact, it fails so completely that we are finally forced to acknowledge, that *the assumption of a monophyletic evolution of the whole kingdom of organic life is a delightful dream without any scientific support*" (p. 15).

He further endorses Fleischmann's assertion that it is impossible to trace back the chief types of the animal kingdom to one primitive form.

This, indeed, is in my humble opinion the conclusion to which the great majority of naturalists would subscribe were they driven into a corner and called upon to tell the truth without "ifs" or "buts." As it is few will speak out so squarely as T. H. Morgan: "It has been pointed out that the evidence in favor of the theory of evolution appears to establish this theory with great probability, although a closer examination shows

that we are almost completely in the dark as to how the process has come about" (p. 454).

Thus it appears, and I entirely concur in the view, that there is good reason for believing in evolution, and almost equally good reason for refusing to accept any definite system, with the exception of the one by sudden leaps, the safety of which theory, apart from its absolute vagueness, lies in the fact that the motive power acts from within. For my part (and I hope that it is not in deference to the tyranny of the *Zeitgeist*) I believe that there is much truth in evolution. But there are limitations. I do not believe that the living came from the non-living, nor that the soul of man was derived from that of an animal. Without pretending to know how evolution acts, I am convinced that its action is a vital one, starting from within the organism and acting according to law, though the details are modified by circumstances. The changes must be more or less sudden, but how great the leaps may be we have at present no means of knowing. Neither do we know

how widespread throughout creation is the influence of evolution.

As already intimated, it seems more in accordance with our poor ideas of Creative Wisdom to have species develop according to a general law than through an indefinite series of acts of special creation. Again beyond question we see an adaptability in living organisms to changing conditions, and it is but a step to believe that this may go so far as to change one species into another, although of this we have no direct evidence. To this is to be added the presence of useless structures and of rudimentary organs; and (though I admit the argument is not conclusive) the appearance of very similar adaptations in very diverse animals, pointing to a general law. The trend of the evidence of the rocks (although I suspect by no means so conclusive as it has been represented) is that higher organisms follow lower ones and that the more complex follow the more simple. There is also reason to believe that some upward changes have no relation to surroundings.

So much for what I *think*; let us now turn

to what men of a certain stamp tell us they *know*. There are quacks in science as elsewhere, and it is the noisiest who sets the pace. They are found out in the end; but it takes time. Here is the advanced doctrine of sham-science: there is neither Creator nor design; but there is matter and force, and that is enough. The living somehow came from the lifeless; between them there is no essential difference. There is a general progress upward and onward, an uplift which presides not only over matter, but over what we call intelligence, which has gradually appeared and expanded till it has reached its highest development in man. Needless to say that there is no hereafter. When man dies we leave him "slowly quickening into lower forms," furnishing new material for future transformations. In what it may be asked is this, I do not say higher, but more scientific than the old-fashioned doctrine that God created living things as they are?

The volume entitled "Darwin and Modern Science," containing the essays read at the meeting held at Cambridge University in

1909, to commemorate the fiftieth anniversary of the appearance of the "Origin of Species," is very instructive in more respects than one. The scientific company it must be admitted was decidedly mixed. True scientists and quacks stood cheek by jowl. It is clear that having met to honor Darwin good breeding demanded that they should say what was pleasant and pass lightly over the rest. Kohlbrugge, had he been present, could not of course have said what he has written: that Darwin's influence had been greatly over-estimated; that he had discovered neither evolution nor descent; that we are indebted to him merely for an attempt to explain the latter according to materialism. But in spite of the necessity of being polite there is a wonderful discrepancy of views. Weismann gives us his strictly materialistic germ theory and tells us that we must accept selection for the reasons mentioned above.

Strasburger assures us that "we can affirm that Charles Darwin's idea that invisible gemmules are the carriers of hereditary characters and that they multiply by division,

has been removed from the position of a provisional hypothesis to that of a well-founded theory."


De Vries, who by the way does not appear ever to have heard of Mendel, concludes his paper on Variation with the statement that Darwin in his doctrine of pangenesis "has given us a clue for a close study and ultimate elucidation of the subject under discussion" (p. 84).

"No one," says Bateson, "can survey the work of recent years without perceiving that evolutionary orthodoxy developed too fast, and that a great deal has yet to come down; but this satisfaction at least remains, that in the experimental methods which Mendel inaugurated, we have means of reaching certainty in regard to the physiology of Heredity and Variation upon which a more lasting structure may be built" (p. 101).

Loeb says: "The discovery of De Vries, that new species may arise by mutation and the wide if not universal applicability of Mendel's law to phenomena of heredity, as shown especially by Bateson and his pupils, must, for the time being, if not permanently


serve as a basis for theories of evolution" (p. 269).

It is interesting in view of this discrepancy among those of the craft to compare the statements at this same meeting of two professors who are not naturalists. "Deeper than speculative philosophy and mechanical science saw in the days of their triumph, we catch sight of new streams, whose sources and laws are still to discover. Most sharply does this appear in the theory of mutation, which is only the stronger accentuation of a main point of Darwinism" (p. 455). So writes Professor Höffding of Copenhagen; while Professor Bouglé of Toulouse declares: "Darwin especially congratulated himself upon having been able to deal this doctrine (immutability) the *coup de grace*: immutability is, he says, his chief enemy; and he is concerned to show—therein following up Lyell's work—that everything in the organic world, as in the inorganic, is explained by insensible, but incessant transformations. 'Nature makes no leaps'—'Nature knows no gaps': these two dicta form, as it were, the two landmarks between which Darwin's idea



of transformation is worked out" (p. 466). Clearly if one of these learned gentlemen is right concerning Darwin's views the other is more than a little wrong. And this at a Darwin Memorial Meeting!

If we turn to the educated community at large comprising college graduates, those that follow lectures and read books and in short look upon themselves as keeping up with the times, we find that their ideas of evolution and of Darwinism are anything but precise. I once remarked that it is curious how many animals of the most diverse kinds suggest in one way or another some resemblance to man (be it in form, in habit, in gesture or expression), whereupon a highly educated lady exclaimed, "Why, Dr. Dwight, that is Darwinism!" If any one will ask any of this class, even a medical student who has gone through college and presumably has studied natural history or comparative anatomy, whether or not he believes in evolution he will promptly reply that he does. Then ask him why he believes in it and the result will be surprising. You will find him quite at a loss for a definite answer and dis-



posed to take refuge in some platitude, such as "the survival of the fittest." He could hardly be more nonplussed if you were to question him on religion.

III

GOD

Synopsis.—The existence of God the starting-point. It can be proved by argument. Faith also teaches what reason demonstrates. The Infinite God must be perfect in all ways. Pantheism: erroneous ideas of God. If God be accepted the supernatural is of primary importance.

“In the beginning God created heaven and earth.”

CLEARLY the fundamental position, the starting-point of all discussion, the basis of any system, rests on the answer we give to the question: is there a God or not?

It is not my intention to prove the existence of God. This is not because the task seems to me a difficult one, but because it has been done by so many of the greatest intellect. If there are those who will not or cannot accept the reasoning already before them, it is not to be conceived that I should offer them anything better.

After all you cannot knock a man down with a syllogism, nor convince him against

his will. Moreover, every man's mind is to his neighbor a book with seven seals. We must not forget that according to St. Thomas the existence of God is one of those truths which is not self-evident but requires demonstration.

Without entering the lists then to prove the existence of God I shall, by way of making my position the clearer, mention some of the arguments which appeal to me the most strongly. I do not presume to write metaphysics. Those who want learned treatises on this subject can easily find them. I offer only some simple considerations.

(I) *Cause*. The need of a cause is probably a self-evident truth. Certainly it is accepted as such in science when any phenomenon is under study. It is absurd that all nature should be causeless. If it is causeless why are not all phenomena causeless too? The theory of a chain of finite causes, each preceding the other, is no escape from the difficulty. It is only prolonging the matter, as for each of the earlier causes a still earlier one is necessary. Nor does it help us to say that the chain of causes is an infinite one.

An infinite number is an absurdity; for to every number one can be added, while infinity admits of no increase. Unless we abandon the principle of causality altogether, we are driven to recognize an Infinite First Cause, God.

(II) *Law*. In all our laboratories we recognize, not only cause, but law. We may think we know the law wholly, or in part, or we may be striving to discover it, but as to its existence we have no doubt. The existence of a law implies that of a law-giver; for a law did not make itself.

(III) *Design*. This is closely allied to law. By believing in design we deny the omnipotence of chance, which, however, hardly requires serious refutation. It is incredible that one man by chance alone should draw the first prize of a great lottery one hundred times running; but this would be the merest trifle compared with the origin of the great harmonies, the adaptation of means to ends, throughout nature. Design implies God.

(IV) *The Moral Law*. That we feel a sense of responsibility, that man acknowledges in his thoughts and conduct a right and a wrong,

even though he may deny that he does so, is to my mind one of the strongest proofs of God. Would any one make conviction doubly sure, he has only to read some of the theories that try to give another origin to our overwhelming sense of responsibility. The only objection of any apparent strength is that the ideals are not the same throughout the race, nay more, that in some cases they are directly contradictory; but this is clearly irrelevant, for the question is not as to what is the duty but as to there being a duty at all. Of vital importance is the point that this duty is very likely to be contrary to the animal nature of man, requiring the imperative interference of his will. He has to choose deliberately an unpleasant instead of an alluring line of conduct. If duty be accepted at all it must be from reasons of a supernatural character. If this world is the be-all and the end-all, clearly every act of self-denial or self-sacrifice lacks an adequate reason. If strength and power and pleasure are our only aims (and if there be no God why should they not be?) every step in morality that leads us from those ideals is in itself idiotic, and

moreover, makes for the survival of the unfittest. How but on the assumption of God can we account for our admiration for virtue and nobility of nature; how explain the longings for higher and better things; and our contempt for what we have in common with the beasts?

(V) The argument, which, I think, appeals to me above all others, is the consideration of what follows the rejection of these several reasons for accepting the existence of God. If there be no God what nonsense and worse than nonsense is every thing! What is life but a particularly bad game of chance?

Balfour in his *Foundations of Belief* (p. 186) complains that "however good arguments of this sort" (from design, etc.) "are, or can be made, they are not equal of themselves to the task of upsetting so massive an obstacle as developed Naturalism. They have not, as it were, sufficient intrinsic energy to effect so great a change. They may not be ill-directed, but they lack momentum. They may not be technically defective, but they are assuredly practically inadequate." It seems to me that this is true in some cases;

but yet one is puzzled to see why good coin should not pass. Is it due simply to the perversity of our adversaries? Or is their mental perception inadequate? I may say for myself that while each of the arguments I have used is to my mind perfectly satisfactory, yet I find an added sense of security from the existence of God being the very root of the Church's teaching.

If then we take the existence of God as a starting-point, we have next to consider what this acceptance of God implies. What are we to think of the Divine Nature? This is no dreamy discussion. It is an eminently practical matter and strictly within the sphere of human reason. It is of practical importance, because it is evident to anyone thinking even most superficially on the subject that an immense deal of harm is done and an immense deal of nonsense, and very mischievous nonsense, is talked simply because men have absurd and perverted ideas of God, which they could by no possibility entertain did they realize what the existence of the absolutely uncaused Being implies.

An uncaused First Cause must be self-

existing, for there is no other possible hypothesis. He must be perfect in all His attributes, or else there could be a more perfect being which therefore could have been the cause of the uncaused—a manifest absurdity. This perfection implies infinity, else it could not be perfect. Thus God must be eternal. How could an uncaused Cause be otherwise? He must be Infinite Intelligence. He must be infinitely good. This attribute of supreme goodness is as necessary as all the others, neither more nor less; but for our finite intellect it is of supreme import. If we admit a God at all this goodness is admitted at the same time as the wisdom or the infinity. Thus we know that His government of the world must be right and just. All this is implied to any sane mind when once we admit the existence of the infinite God. Is it really worth while to talk about a non-infinite God? If so why not write a book on square triangles?

For these reasons, among others, the existence of God is to me an absolutely certain fact, and consequently the foundation of all science. It is worth while to glance at some

of the difficulties which others experience. The general note of the ideas of those outside of the Catholic Church is their extreme vagueness. Some will speak of the Supreme Being, some of the Creator, some of the Animating Spirit of the world. Others following Herbert Spencer, while declaring their belief in God, disclaim any pretence to a knowledge of His nature.

Now it is certain that man's knowledge of God must be in the highest degree inadequate in the sense that an adequate knowledge is one so comprehensive that it does full justice to the nature of the subject known. The same is also true of the knowledge of God possessed by the highest created intelligence, simply because the finite cannot grasp the Infinite. On the other hand, the existence of God, the First Cause, having once been proved, man by the further exercise of his reason can gain such knowledge of His attributes and perfections as to know that he owes as a right all his reverence and love to his Creator. In this sense God most certainly is knowable.

Needless to say that these views are fatal

to pantheism, of which a few words should be said, both on account of its popularity, of its persuasiveness, and its increasing influence. It comes as a relief after materialism, and presents itself as almost a spiritual system. At first sight it does not seem to deny God. On the contrary, it is put forward as honoring Him, inasmuch as it brings Him into greater prominence as the immanent principle of all things. A literal interpretation of Pope's well-known lines:

"All things are parts of one stupendous whole,
Whose body nature is and God the soul."

is distinctly pantheistic, though such was not the intention of the poet. It is one thing to say that all creation is absolutely dependent on God, that it is kept from falling back into nothingness solely by His supporting will, and another to say that God and nature are inextricably blended so as in fact to be one.

The refutation of pantheism is easy. It destroys all distinction between matter and spirit, and, worse still, between Creator and creature. The stone falling by attraction while obeying a physical law is in some in-

comprehensible way manifesting Divine action. All physical phenomena, all mental processes, all spiritual acts become at once of the same value. Just as it becomes impossible to separate a stone from God, so it is with all animal life and with man's soul. Right and wrong and free-will necessarily go by the board. The basest cravings of our lower nature and the highest aspirations of our spirit are thus reduced to the same basis; each hangs to a certain extent on the act of God. Yet if we can know anything whatever, we know that we are ourselves and that we are not God, and that we have free-will. Volumes have been written, but we get very little further than this refutation from common-sense.

When, however, we speak of God's plans and purposes we are dealing with something absolutely beyond our sphere. Great Catholic philosophers like St. Thomas Aquinas show the way to higher views, but we poor men in the street almost of necessity take what are called anthropomorphic ideas of God. This is one of the standing sneers at religion, but in point of fact the distorted images

which the sneerer presents as the views of believers are illustrative, chiefly, of his own narrowness. Perhaps at times he may mean to caricature Christian belief, to make it as repulsive as he can, but probably in most cases his absurdities come from his own inability to rise above the crudest and lowest conceptions of God. Of course everyone's ideas of God depend largely on his early education; and we take too little thought of the difficulty of making due allowance for others. Thus in Holmes' poem of the battle of Bunker Hill the old grandmother tells how, when as a girl watching it from the steeple, at the sight of burning Charlestown she burst forth:

"May the God in Heaven confound them,
Rain His fire and brimstone round them!"

Surely those who look upon fire and brimstone as God's most characteristic attributes must have a conception of Him which to most of us appears monstrous. There is no doubt that it was familiar enough to our Puritan ancestors; but let us be careful that we do them no injustice. True, they dwelt on the attributes of terror, but I like to hope that

they did not quite overlook the milder and more gracious ones.

Herbert Spencer in a celebrated review of a work by Richard Owen, to which I shall refer later, alludes to "those whose conceptions are so anthropomorphic as to think they honor the Creator by calling Him 'the great Artificer.' " I own that I share Spencer's dislike of the phrase; but are we justified in assuming that they meant it literally? In fact agnostics have a provoking way of setting up for destruction idols of their own which they pass off upon us as the fetiches of others. It is almost the more provoking that it may be done in perfect good faith. I received a striking illustration of what I may call agnostic stupidity on a wonderfully magnificent starlight night in mid-Atlantic, when the passengers often paused in their walk along the deck to admire the beauty of the heavens. As I passed a well-known materialistic professor I heard him remark to a lady: "And once they thought that these stars exist to show the glory of God!" Strange that this learned man had not the sense to see that it is not only by their beauty

but in fulfilling perhaps myriads of physical purposes that the heavens declare the glory of God, and that the more we know of them the more that glory is manifested. Perhaps he was not aware that this thought is expressed in the very next words of the psalm: "and the firmament declareth the work of His hands." Very probably, however, he would have considered the work of God's hands as a bit of the grossest anthropomorphism. Yet even Max Müller said:¹ "Our eyes must have grown very dim, our mind very dull, if we can no longer perceive how the heavens declare the glory of God."

Cardinal Wiseman sets right in a fine passage in "Fabiola" an anthropomorphic objection which most of us have heard with minor variations. The heroine says: "But, Syra, can we think that a Being such as you have described . . . can occupy Himself with constantly watching the actions, still more the paltry thoughts of millions of creatures?" To which the Christian slave replies: "It is no occupation, lady, it is not even choice. I

¹ Life and Religion. Gifford Lectures, II.

called Him light. Is it occupation or labor for the sun to send his rays through the crystal of this fountain to the very pebbles in its bed? See how of themselves they disclose, not only the beautiful, but the foul that harbors there; . . . not only the golden fish that bask in their light, but black and loathsome creeping things, which seek to hide and bury themselves in dark nooks below; for the light pursues them. Is there toil or occupation in this to the sun that thus visits them?"

In the same way when we hear of repeated acts of creation imposing an effort on the Almighty we must see that the idea is anthropomorphic and unworthy. But it is a great mistake to suppose that we cannot by reason attain to great and grand ideas of God which are in no way tainted by anthropomorphism. If anyone doubts this let him read the Summa of St. Thomas Aquinas.

The operations of an Infinite Being can by no possibility be grasped by a finite mind. This is mortifying to our vanity, but logically it must be so. We can only "know in part." This may be humiliating to us; but if so, it is only because we have misunder-

stood our position. On the other hand, it is not saying that we cannot learn much, and always go on learning, and our descendants after us, till the end of time. Nor is it saying that such knowledge is not to be longed for and sought after.

I have been told that the idea of an infinitely good and at the same time an infinitely just God seems to involve a direct contradiction. I acknowledge the difficulty: but it does not in the slightest affect my belief in both of these Divine attributes. If God were less than just there would be imperfection, which is impossible. The coexistence of these attributes is beyond our imagination but not in the least beyond our reason. The difficulty disappears when we consider the alternative: the necessity of giving up a First Cause altogether. Difficulties of this kind give no excuse for saying that God is unknowable. They simply show that reason cannot fully comprehend Him. Some seek a refuge by simply withdrawing from the controversy and saying, "we do not know." But under these circumstances to say one does not know is in the words of

Père Didon¹ "the dishonest way of denying."

Having once accepted the idea of God, the Perfect and the Infinite, we must know Him as Creator of the world and acknowledge a system, far transcending the laws of nature, which shall be in force after the present order of things shall have passed away. This is no more than saying that the laws of nature do not give us the clue to the highest purposes of God. This goes against the grain with many; but it is a logical necessity, God being once admitted. There is no escape from it. It is probably for this very reason that so many reject all consideration of God in science. They seem to have an idea that this conception pulls the basis of science from under its feet. They do not appreciate that this does not invalidate physical science but only shows that there are realms far above it. They labor under an extraordinary delusion that a law, apparently self-established (whatever that may mean), can in time be more or less grasped, but that the scheme of the Supreme Intelligence is necessarily unintelli-

¹ La Science sans Dieu.

gible. On the contrary, it is worthy of our most enthusiastic study.

Now comes the question: has science shown us anything to invalidate belief in God? This belief, once at least, seemed a perfectly reasonable one. As all our knowledge of God, revelation apart, is in the domain of pure reason, science, i. e. physical science, cannot directly touch any point at issue. The most that it can do is to show us a state of affairs utterly inconsistent with the theory of an infinitely good and wise Creator. There have been in the past the philosophers of pessimism to whom all was black and evil. Certainly if one does not look upon God and religion with faith there is much to make this plausible. It is to me inconceivable that a good God could make a world like the present one were it the be-all and the end-all. To those who look upon it as a world of trial the difficulty disappears, that is as far as man is concerned. But, for I wish to make the objections as strong as they deserve to be, what about the lower animals? Does any future of reward for man repay them for their sufferings? There is no convincing answer. The

mystery of evil is beyond us. Some tell us, and tell us truly, that the want of reason in animals takes away the bitterest stings of pain, those of memory, and above all those of anticipation. It may be so; but even then there seems to exist a residue of suffering above comfort which is appalling. We do not see the solution; but we put the question aside knowing that there must be an explanation, though we cannot see it now. So with the doctrine of spiritual evil and its eternal punishment. We can see its justice and its necessity, yet the human mind shrinks from it. We cannot see the answer; but we know that God is good. After all, these difficulties are not new ones; they are to-day precisely what they were centuries ago: no more, no less. Modern science has added nothing to the difficulty.

Since God exists we know that the riddle of the universe has an answer. God must have created the world for an adequate reason—for one worthy of Himself. To think otherwise would be an insult to God and to our reason. But in this case the purpose, being worthy of God, must be a supernatural one

dealing with higher things than matter, even than living matter. Hence the supernatural in creation is not of secondary but of absolutely primary importance. It must be acknowledged as frankly as we accept any law of matter. It is not indeed for us to speak of it as if we could grasp it, as if we knew God's secrets, but its existence is not to be forgotten. Thus the Catholic's view of the universe is immeasurably greater and grander than that of the materialist, for it extends to when time shall be no more, and it rests upon God.

IV

RELIGION

Synopsis.—What religion is; absurdity of calling it an emotion. Man created to serve God. The effect of Adam's sin upon man. The Church, the Catholic view of Creation.

IF we are to discuss this question rationally we must first start with adequate definitions. Self-evident as this seems the practice has by no means always been followed. Faulty definitions have in many cases made the whole subsequent argument worthless. Let us now try to define what religion is in itself, and then what the Catholic religion teaches that concerns this discussion.

Religion, from the verb *religo*, is, according to St. Augustine, the link that binds man to God. This strikes one at first as rhetorical rather than exact, but it will bear examination. The more one thinks of it the more satisfactory it becomes. This implies first the existence of God with all His infinite

attributes. It implies further that man is conscious of having immortality and free-will; that in some way and to some extent he has been brought into relation with God's plans, and that he acknowledges God's right to his worship and obedience. Now the acceptance of these truths from a purely natural standpoint constitutes what may be called natural religion, but the embracing of revealed mysteries comes by faith, springing from a supernatural gift of God.

It is now the fashion, in a certain set, to declare that religion is an emotion. Nothing could be more fantastically absurd nor more untrue. An emotion is a state of mind in which a strong impulse or impression weakens or even suspends the action of reason so that the will yields to an overmastering desire. Let us suppose that two men are caught in a burning theatre. Both have a perfectly reasonable wish to get out. One under the influence of fear rushes blindly forward, regardless of his chances of escape and reckless of what harm he may do to others whom he brutally throws down and tramples under foot. He is acting by emo-

tion. The other man before moving considers quickly but coolly which are the possible ways of escape and selects the most promising one. He is acting by reason, but it is highly probable that after his escape he will be overcome by emotion. When a man considers deliberately whether he will accept the doctrines of the Catholic Church, and having prayed for guidance in making his decision and for strength to stick to it when made, finally acknowledges the Church's claims, he may or may not experience an emotion (probably he will experience a great emotion), but his action is not the result of emotion; on the contrary, it is the cause of the emotion. Suppose he remains true to his religion through great trials, from which he could free himself by being false to his convictions, have we any right to say that this is emotion? There are plenty of instances of men and women persevering faithfully for long years in austere orders, in which the life is of the hardest, without the support, the sensible fervor which is granted to some. They went on when all was hard, pleasureless, nay repulsive. Was

Father Damien's long work among the lepers the result of emotion? That religion may awaken emotion is most true, just as exercise may awaken appetite, but the emotion is no more the religion than the appetite is the exercise. It is but too true that people may turn to religion under a passing emotion, just as under emotion they may make foolish investments; but what of it? It is far less absurd to define the stock market as emotion than to do the same to religion. In point of fact it is hard to see how any thinking person can seriously support this view.

So much for what religion is; let us now consider more particularly what religion teaches that concerns science. We believe in God, infinite, absolutely perfect in His wisdom, His mercy and His justice. We know therefore that when He made man it was for an end worthy of Himself, far transcending human understanding. The catechism tells us that it was to love and serve Him in this life and to be happy with him forever in the next. Let us think for a moment what this implies. Who makes this offer? God Himself. This happiness, then, is altogether

supernatural. Heaven is not what so many seem to think it: a kind of glorified picnic with pleasing music and the society of old friends. If it may be said without offence this seems to be the idea of eternal blessedness among non-Catholics. The great defect in this view, apart from its materialistic nature, is that of omission. Nothing is said of God; and yet the beatific vision of God imparting knowledge and love is alone the essential happiness of heaven. Everything there is supernatural. The risen body has new powers which presumably we never dreamed of. "Eye hath not seen, ear hath not heard, nor hath it entered into the heart of man what joys God has prepared for those that love Him"; but far above all, as Catholic theologians tell us, this knowledge and love of God bring about a union with Him by which the soul without losing its identity glows in the immensity of God as a coal glows in the fire. And of this there shall be no end. For this destiny God created man. So much we know now, but Infinity being unfathomable, the very highest intelligences can never reach to the depths of God's

reasons for doing it. They may continually see new and more stupendous reasons of goodness and wisdom for the act, but to the deepest depth they can never come.

Needless to argue that man thus made, absolutely dependent on God, is not his own master, but God's servant. He has been endowed with reason and the terrible responsibility of free-will. Moreover, he is immortal. Never shall the time come when he shall cease to be. He shall outlive time itself in the, to us, incomprehensible present of eternity. He is here on earth on trial. So far as we know, the earth and all physical creation exists that this trial may take place. At least we know that this trial involving the eternity of one single soul is of infinitely greater importance than all non-rational creation. Whether there are other rational beings on other orbs and what other purposes the universe may serve are things of which we know nothing. It is all a matter of speculation. The theory of the existence of other beings was attractive to me long before the "Canals of Mars" were discovered. It would not be the less attractive

should they prove to be imaginary. Nor is the nature of the atmosphere of planets to the point. May there not be creatures who can live and think without oxygen? They would be very unlike vertebrates, but that is no argument against their existence. But after all the question is quite irrelevant. What is now insisted upon is this: that God having appointed this probation for man, the disposition of the universe, the structure of nebulae and suns and systems of senseless matter, though expressed in terms implying age, size, weight, distance, speed beyond imagination, is of absolutely secondary importance.

The Catholic Church teaches that the first man was created in a condition distinctly higher than our present one. His reason held his lower nature in full subjection and death, as we now know it, was not to close his life, but, having stood the test, he was to enter into heaven without separation of soul and body. Now all this is of *faith*. That is to say that Catholics are bound to believe it. It is the reverse of my intention to minimize what to outsiders may

seem the burdens laid upon us. When Adam fell death was in store as a punishment for him and his race, for him because he fully deserved it, for his race because the supernatural condition of the first man was no right, but a gratuitous gift to which the descendants have no claim. Moreover, the consequences of that sin left man's descendants with a less clear vision of the higher things and with lower tendencies and passions no longer held in subjection. All this too is *of faith*.

We further believe that God in His mercy has given man a revelation, has redeemed him, and has established the Church, unerring in faith and morals, to be his guide. It was indeed intrinsically possible that redeemed man might, without the aid of a Church, have persevered in the intelligent and faithful service of God; but the possibility is merely speculative. It is in the same way intrinsically possible that a man may accomplish any difficult feat with the odds thousands to one against him; but practically he does not do it. How great is the need of the Church is shown by the religious condi-

tion throughout the world, by all the forms of paganism, by the confusion of the various sects of so-called Christianity, and by absolute atheism. If things are as they are when there is a Church, what would they be had we been left to ourselves?

Here then is the Catholic view: Man, God's creature, not a little higher than the beast, but a little lower than the angels, now fallen from his higher estate is (or should be) in fear and trembling working out his salvation, aspiring to an eternity of endless glory with God, supported on his way by revelation and guided by the Church.

Mallock, in his "Religion as a Credible Doctrine," selects the existence of God, the freedom of the will and the immortality of the soul as the essentials of religion. They may suffice for a philosophical discussion, but my purpose not being to show that there is no opposition between religion and science, but that the religious conception of creation is in itself so magnificent in its scope, so clear in its details, and so explanatory of human nature as to be both a reasonable and a satisfying doctrine, I have been forced

to go further. Perhaps some readers will be surprised in spite of the declaration that we accepted frankly the supernatural, nay more, made it the starting-point, at the expression of belief that but for the fall man would not have been mortal, and that intellectually he was far higher than he is now, involving as it does the terrestrial paradise. It is really a little startling to be told that man (who as everyone knows from newspaper science came last from an ape and first from a spore of uncertain origin) was once a very different creature from what he is now, and that he would have become glorified in body and soul without any preliminary separation of one from the other. Having admitted the supernatural there is nothing really extraordinary in it. Why is it not perfectly reasonable to hold that God so decreed?

Many, I suspect, make a needless difficulty to themselves by saying that they cannot imagine such a condition of things. They feel called upon when thinking of man before his fall to conjure up images of a garden with well-raked walks and neatly-clipped hedges. Any such image must inevitably

be inadequate and moreover fantastic and absurd, just in proportion as one tries to make it realistic. But, as has been shown already, imagination is not the criterion. There is nothing unreasonable in the idea of probation as a preliminary to reward or punishment. It is contrary, to be sure, to the ideas of the times; but then I had rather believe in the infallibility of the Pope than in that of the *Zeitgeist*. After all the crucial point is this, that if we believe in God our religion must be supernatural throughout. This life and this world are but episodes in a tremendous and supernatural drama. The eternal future of every individual man is at stake, of man, who contemptible as he may appear to himself and his neighbors, is of enough importance to draw the Son of God from heaven to redeem him by death. The future of the angels has been decided; but those of them who stood and those who fell are permitted to take an active part in man's struggle. The solar system, nay the universe, is to pass away to give place to "a new Heaven and a new earth." These are things that we believe; let us not make

the mistake of being ashamed to acknowledge them. In fact they are the only things that matter. And finally all the end results are as much above our conception in our present state as mathematics would be were there, not only a fourth, but an indefinitely larger number of dimensions in space. Truly this seems fantastic and extraordinary. The supernatural is indeed overwhelming! Yet all this follows logically from accepting the existence of God.

V

DESIGN AND PLAN

Synopsis.—If we accept God as the Creator we accept design and plan. Blunders from anthropomorphic conceptions. Design. Plan implies a pattern. The archetype skeleton, symmetry, extravagant ideas. Richard Owen's book, Herbert Spencer's criticism. Revival of the archetype. A reproduction of God's perfections. Evolution not excluded. The late Marquis of Salisbury on Mendeléeff's law. Law and order in the non-living.

SINCE we have begun by admitting God's existence, or rather since we have taken it as the corner-stone, we recognize in Him the Creator. The difficulties which now surround us come from the inability of our finite minds to grasp all that creation implies. Again the trouble is not with our reason so much as with our imagination. The idea that Omnipotence can make something out of nothing is clear enough and sound enough; but there are those who puzzle their minds by trying to imagine how it is done, and so cannot get rid of anthropomorphic conceptions.

There are two fundamental ideas in this question, namely: design and plan, which though much alike are not the same thing. By design is meant (expressed as it must be in our ignorance in language which at least seems anthropomorphic) the intention to make a certain thing with a distinct knowledge of what it will be and of what under given circumstances it may become. This idea of design, simple as it is, proves a stumbling-block to many because they have a fanciful and entirely wrong idea of what design implies. Darwin asked if his nose was designed. A foolish speech by the way and quite unworthy of him. As well ask whether the rings spreading over the water from a falling stone are designed. They are formed in accordance with certain physical laws. They vary with the size of the stone, and the height from which it descends. They vary also with the depth of the water, with its condition, whether it be at rest or flowing, and whether it be on a calm or a windy day. In the same way the shape of a person's features depend first on the laws of generation, modified by those of heredity and prob-

ably by others of which we know next to nothing, such as the influence of surroundings. Moreover, many circumstances during childhood, such as health, climate, mode of life, must be counted. Design it seems to me is implied by the very fact of the establishment of those laws. It is none the less design, because details can be modified by what we may call accidental circumstances.

The idea of plan is one of much greater practical importance in the discussion of the biological problems of the day. It implies an ideal pattern, the chief lines of which persist in spite of great modification of details. To all intents and purposes it is synonymous with "type." The term is used alike by those who support and those who scout the idea of design, though the latter seem to be unaware that in using it they are guilty of grave inconsistency. The vertebrate type is a household word. We recognize one type for worms and another for jelly-fish.

One could hardly offer a better illustration of the changes in anatomical thought, and also of the ebb and flow of currents and counter-currents of theory, than by recalling the

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old idea of the archetype skeleton which in my early days of anatomy perplexed, fascinated and haunted me. To define the archetype is not easy. The theory dates, I believe, from Plato, who held that all created things first exist as ideas in the Creative Intelligence, and that consequently when called into existence they are reproductions of this idea. This is also the teaching of Catholic philosophy. In the case of vertebrate, that is back-boned animals, the ground plan seems to involve symmetry first of all. It also involves a serial repetition of parts each of which is supposed to contain the same elements variously developed. Thus, to take a concrete example, when Goethe in the Harz Mountains picked up a deer's skull and exclaimed, "It is a vertebral column!" his train of thought implied such a conception. He saw in the head the modification of a structure that exists in a series throughout the trunk. It was a brilliant generalization. He published his vertebral theory of the skull in 1807, and in the early part of that century the various plans of the archetype vertebrate skeleton were discussed among anatomists

1807

with the greatest vehemence. Roughly expressed, it may be said to be that the trunk is formed of a series of segments, vertebræ, which, put together like a roll of coins with a plate of gristle between the bones, form a rod¹ with an arch above and below it. The pieces of bone forming each segment of these structures may be either all united, or some may be separate. Thus the ribs, which in the chest are free, are represented in other parts by projections from the vertebræ. We see modifications of the vertebræ as we proceed from the middle towards the head or the tail. In the head the plan increases in complexity, in specialization; in the tail one secondary part disappears after another till merely the centre remains. There are two pairs of limbs, attached to the trunk, and according to most authorities made of elements that are auxiliary to those of the vertebral system. But, as might be expected, when men devoted to natural history, and without philosophical training, abandon the study of actual facts and take to theories, especially to such as are of a transcendental nature, they soon lose

¹ This rod is supposed to be horizontal.

their foothold on the sure ground of common-sense and flounder in the wildest dreamland. Indeed the archetype of the vertebrate skeleton soon became nothing short of a nightmare. There was serious disagreement as to the number of vertebræ represented in the skull. Oken saw three and a rudiment, Owen four, Carus six, and St. Hilaire seven. Oken and his more extravagant followers would have in the head not merely a repetition of vertebræ, but of the whole trunk with all its systems. Thus the jaws came to represent a pair of limbs; the nose, the thorax and lungs; the mouth, the abdomen and intestines. If anyone with a general knowledge of anatomy would have a warning of what nonsense men of merit can write, let him turn to the article "Skeleton," written some sixty years ago by MacLise in Todd's *Cyclopædia of Anatomy and Physiology*.

Moreover, the archetype was held to be essentially symmetrical. This seems simple enough till one tries to determine precisely what constitutes symmetry, when we find ourselves face to face with most perplexing problems. First there is lateral symmetry,

by which either side is theoretically at least a repetition of the other as in a looking-glass. Next there is serial symmetry, as in the repetition in the trunk of one vertebra after another, and in the limbs of one piece after another in different limbs as the hip corresponding to the shoulder and the foot to the hand. Here we begin to get into serious difficulties. Hip clearly corresponds to shoulder, thigh to arm, knee to elbow; leg to forearm; ankle to wrist; and toes to fingers. But when we come to more accurate details difficulties surround us. In the matter of the limbs we see in mammals that the elbow is pointed backwards and the knee forwards, that the bones of the forearm are crossed when the hand is brought into the same position as the foot. Such puzzles have made men wonder whether the method of comparison were not at fault. According to some, for instance, the hind half of the body of a quadruped should be compared with the front as the left half is with the right. In that case, of course, the complex head is represented by the rudimentary structures of the tail. Again, as in this conception the parts are compared after

the fashion of those of an oblong table, one side and one end to their fellows, further question arises as to whether one leg of the table or one limb of the animal should not most properly be compared to the one diagonally opposed to it, as for instance the right arm with the left leg.

Needless to say that very confusing results arise from these various methods. Does size count for anything? Is the great toe to be said to correspond to the thumb on account of its size and of a superficial similarity, when according to some the little finger is the more probable representative? I have heard a distinguished naturalist say to a class that he would stake anything short of his eternal salvation that the thumb corresponds to the little toe and the little finger to the great toe, and that he should think his life well spent in establishing the doctrine.

Goethe's publication of his theory in 1807 was followed during the next half century and more by the dreams of numberless transcendental anatomists with plans of their own, showing all degrees of imagination with occasional glimpses of reason, till in 1858

Richard Owen, the celebrated English anatomist, may have thought that he had put the Archetype Skeleton firmly on its feet by a publication with that title, which, unlike many others, was a sober and serious study. But the book appeared just as the forces tending to the destruction of the whole system were coming to a head.

The beginning of the end was a review by Herbert Spencer of Owen's Archetype Skeleton.¹ It was a model of destructive criticism. He begins with a sentence which I quote with the wish that it were more generally remembered: "Judging whether another proves his position is a widely different thing from proving your own. To establish a general law requires an extensive knowledge of the phenomena to be generalized; but to decide whether an alleged general law is established by the evidence assigned merely requires an adequate reasoning faculty. Especially is such the case when the premises do *not* warrant the conclusion."

He then proceeds to tear the poor arche-

¹ *British and Foreign Medico-Chirurgical Review*, Vol. XXII, October, 1858, p. 400.

type vertebra to pieces, to very rags. "In no class of facts," he exclaims, "do we find a good foundation for the hypothesis of an ideal typical vertebra. The alleged group of true vertebral elements is not distinguished in any specified way from bones not included in it. The entire group of typical elements may coalesce into a single bone representing the whole vertebra; and even, as in the terminal piece of a bird's tail, half a dozen vertebræ, with all their many elements, may become entirely lost in a single mass. Lastly, the respective elements, when present, have no fixity of relative position: sundry of them are found articulated to various others than those with which they are typically connected; they are frequently displaced and attached to neighboring vertebræ; and they are even removed to quite remote parts of the skeleton. It seems to us that if this want of congruity with the facts does not disprove the hypothesis, no such hypothesis admits of disproof."

When Spencer comes to the discussion of the application of the theory to the skull the refutation is even more complete, for the

theory was manifestly untenable in the light of the science of the day. "Plato's argument that before any species of object was created, it must have existed as an idea of the Creative Intelligence, and that hence all objects of such species must be copies of this original idea, is tenable enough from the anthropomorphic point of view. But while those who with Plato think fit to base their theory of creation upon the analogy of a carpenter designing and making a table must yield assent to Plato's inference, they are by no means committed to Professor Owen's expansion of it. To say that before creating a vertebrate animal God must have had the conception of one, does not involve saying that God gratuitously bound Himself to make a vertebrate animal out of segments all moulded on one pattern."

But if we are to put aside the idea of plan how are we to account for the general similarity of the vertebræ of the different regions of the spine? Here is the gist of Spencer's argument: "It is impossible to deny that if differences in the mechanical functions of the vertebræ involve differences in their forms,

then community in their mechanical functions must involve community in their forms. And as we know that throughout the vertebrata generally and in each vertebrate animal the vertebræ, amid all their varying circumstances, *have* a certain community of function, it follows necessarily that they will have a certain general resemblance—there will recur that average shape which has suggested the notion of a pattern vertebra.” He then explains that the spine becomes what it is from the necessity of hard parts for strength and of many joints between them for flexibility. “Thus there would obviously arise among them a general likeness, due to the similarity of their mechanical conditions, and more especially the muscular forces bearing on them.” Then with an honesty which is rarely shown in these controversies he lays bare the weakness of his own argument, and later offers further explanations in support of it. I would call particular attention to the following passage which directly follows the last quotation. “But it may be replied, this hypothesis does not explain all the facts. It does not tell us why a bone whose function

in a given animal requires it to be solid is formed not of a single piece, but by the coalescence of several pieces which in other creatures are separate; it does not account for the frequent manifestations of unity of plan in defiance of teleological requirements. *This is quite true.*"¹ He would explain it by the superposing of one adaptation upon another. He concludes: "And these typical similarities, which are traceable under teleological modifications, would obviously exist if throughout creation in general there has gone on that continuous superposing of modifications upon modifications which is displayed in every unfolding organism."

This review was very fatal to the archetype. For my part I am quite clear that the last explanation does not remove the mystery which Spencer himself states in such plain language; but shortly after this Darwin's hypothesis appeared. It was some years before it gained anything like general acceptance, and in the meantime the transcendentalists still plied their dreary trade; but with the progress of the theory of evolution

¹ Italics ours.

the archetype went under a cloud. The influence of evolution, as at first understood, was fatal to the underlying idea of plan; for, be it noted, an archetypal idea implies a Mind, and consequently design. The whole trend of the teaching of evolution at first was to overthrow all faith in a Creator and Designer. Why this should have been so is not clear. With many, no doubt, "the wish was father to the thought." There were few in the scientific world for a long time who had the sense to see and the courage to declare that between evolution (or at least a modified evolution, not that of Hæckel) and design there is no kind of contradiction. But queerly enough those who do not believe in design, or put the thought aside as many do, yet recognize that there is symmetry, that there are homologies, correspondences easy to see but hard to define, which must be reckoned with.

The fall of the archetype was hailed with general satisfaction, even by those who had not accepted the new doctrines. For one I had become so weary of its vague mysticism, so perplexed by the contradictory interpreta-

tions, so annoyed at the waste of time on a problem which became more and more obscure, that I could have danced on its grave. None the less there was a feeling, which has since shown itself well justified, that Spencer's victory was much less complete than it seemed. Because Owen saw fit to commit himself to a definite material archetype which could not withstand criticism, it does not follow either that all idea of plan is to be abandoned, nor that the idea of a certain plan represented in successive sections of the body with modifications in each is not justified. Spencer's theory of accumulated modifications does not in the least solve the difficulty. How does it account for the persistence in one part of the spine, say the sacrum, of a rib element which is absolutely useless as a separate piece? Were there no principle which secures its survival it should have been eliminated long ago. Heredity is appealed to in vain. Yet here is the mysterious element appearing in the young as a distinct piece which later loses its identity. On the other hand embryology, which fifty years ago was in its infancy, confirms distinctly the view of

the archetype. The hind part of the skull (technically the occipital bone) is the only part in which the plan of a vertebra is easy to recognize in the skeleton; but recent microscopic researches in the developing animal show that this represents not only one vertebra but several, and further, that the hind segment of the brain, the medulla oblongata, shows far more striking resemblances to the spinal cord than had originally been dreamed of. We have here both in bone and brain of the embryo the signs of the early existence of many segments of which in the adult we find no trace. Although embryology has not solved all questions concerning the homologies of the limbs, it has simplified our conception of the problem. In fact the archetype is with us again, but with a new name. We now discuss the "primitive vertebrate type" from which higher forms are evolved. The archetype of old proclaimed a Creator: its successor under the influence of its managers is too prudent to proclaim anything. If questioned it shrugs its shoulders, murmurs something about heredity, and, "smiling, puts the question by." But let us

who frankly accept the archetype be more discreet than our predecessors. From the very fact that we believe that archetypal ideas are and can be only in God we must not attempt to go into details, still less may we try to draw these details on the blackboard in many-colored chalks. We must be content to recognize certain general features and by patient study slowly to extend our view, recognizing beforehand that the most that we shall know of such matters in this life will be, compared to the truth, as a mathematical point is to a line.

But what in plain language does all this mean? Does it mean that we must revert to old ideas and believe that God created all animals just as they are? Are they but representations of ideas so grand that we can never hope to grasp them? Is it not a grotesque affectation to see in a worm or a snail or a flounder the representation of Divine ideals? Thus grossly stated the objection seems strong; but the strength is only apparent.

We have accepted God the Creator, the sole Self-existing Being. If it pleased Him

to create a world and living beings upon it, all, everything and every animal must in some degree and in some manner feebly imitate the Divine attributes, simply because there neither is nor can be anything else for them to be modelled from. Spencer calls this an anthropomorphic conception; but no conception can be less so. If he imagined God as a carpenter selecting a pattern, thinking it over, and gradually making something like it, the idea is anthropomorphic and silly enough, but the absurdity is in his conception, not in the fact. There is no past, nor future in God; such a comparison, therefore, is absurd. That God should will these imitations of Himself in creation is not absurd, but the thought is bewildering and overwhelming. Imagination again fails us; but reason humbly assents, seeing that, speaking with all reverence, He can make creatures imitating nothing else. This does not in the slightest imply that there may not have been modifications and changes. Why should we doubt that just as the physical universe has seen wonderfully progressive changes, so living creatures have become more com-

plex and very different from what they were earlier? Further, why should we doubt that these changes may be greatly modified by surroundings, as shown by the illustration of the stone falling into water, and that yet in spite of this we should still see, now clearly, now darkly, traces of a plan which we know not enough to grasp? If God exists there certainly is plan. We have started with God's existence as the primary fact. Hence plan must extend throughout creation, and be manifest alike in the living and in the inorganic: there can be no escape from it anywhere.

I have been deeply impressed by some remarks of the late Marquis of Salisbury at the Oxford meeting of the British Association for the Advancement of Science in 1894. They cannot have been pleasing to many of those who heard them; but yet, so far as I know, they have never been answered. In fact it was one of those attacks which can only be ignored: silence was the only resource of his adversaries. "Professor Mendeléeff," he said, "has shown that the perplexing list of elements can be divided into families of about

seven, speaking very roughly; that these families all resemble each other in this, that as to weight, volume, heat, and laws of combination, the members of each family are ranked among themselves in obedience to the same rule. Each family differs from the others, but each is internally constructed upon the same plan."

What was weakness in this theory "was turned into strength," to quote again his words, by the discovery of certain elements which were wanting in some of the groups when the law was first announced. "The discovery of these coördinate families dimly points to some identical origin, without suggesting the nature of their genesis or the nature of their common parentage. If they were organic beings all our difficulties would be solved by muttering the comfortable word 'evolution'—one of those indefinite words, from time to time vouchsafed to humanity, which has the gift of alleviating so many perplexities and masking so many gaps in our knowledge. But the families of elementary atoms do not breed; and we cannot therefore ascribe their ordered difference to

accidental variations perpetuated by heredity under the influence of natural selection."

Thus we see curious arrangements in inorganic nature distinctly proclaiming law and order, which cannot be explained away by the slang which in biology is allowed to pass for argument. If then there be law and order in the lifeless which can be accounted for only by assuming an intelligent Creator (for the doctrine of blundering chance is really beneath contempt), why, in the name of reason, are they to be excluded from the realm of the living?

VI

LIVING AND NON-LIVING

Synopsis.—Differences in the reaction of living and non-living, and of animals and man. Differences between living and non-living (a) in structure, (b) in self-motion, (c) in reproduction, (d) in effect of use, repair, (e) sensation. Necessity of a vital principle. Vital force supplemented by mechanical, the neck of the thigh-bone, the recurrent laryngeal nerve. Persistence for a time of vital action after death. Life is immanent action. The vital principle at first a new creation. It may be capable of evolution.

It is an old axiom that whatever is received is received according to the nature of the receiver. Let us suppose that men at work on a staging should allow from time to time a white-hot bolt used in fastening steel framework to fall from a portable furnace into the street below. We will imagine that one day it falls upon gunpowder, another day upon flax, and another into water. The result of the contact of the bolt

with each of these substances will be entirely different, but the important point is that it will be absolutely certain. Given the size and heat of the bolt, the distance it falls, the quantity and arrangement of the powder, flax or water, it would be perfectly possible for an expert to predict precisely the details of the resulting changes. Should the bolt fall upon a living tree or plant, injuring but not destroying it, the expert might at least in theory predict the resulting damage. But this damage once done, a new series of phenomena begins of which the preceding experiments have given us no hint, which differs radically from anything we have yet observed, announcing the process of repair by which the injury to a greater or less extent is made good. Suppose now that the white-hot bolt drops upon a short-haired dog. We have again a new element in the problem. There will be cries of pain and convulsive movements consequent on the destruction of the skin. Again there will be more or less perfect repair; but we now pass beyond what can be predicted. We may grant that were it possible for a physiologist

to know the precise state of the dog's health, in addition to the facts concerning the bolt, he might predict by a mathematical calculation the amount of the injury; but that is the most he could do, and that is not all that is needed. On the one hand the dog after the injury may be tormented and enraged by a set of mischievous boys so that he will make more and more convulsive movements, and that cries of fear or rage and snapping of teeth may occur; or on the other hand he may be soothed into quiet by the touch of a kind master. As in the case of the plant, a series of phenomena will take place in the wound. Dead tissue will gradually be sloughed off, and new tissue will be formed by cell changes. The injury will be more or less perfectly repaired. More than this: the process will vary according to varying conditions during the healing. The cells will act in one way with no dressings, in another with those of a certain kind, and in others with still other dressings. In short, the living tissue in the process of repair will adapt itself to circumstances.

One more illustration. Let us suppose

that the bolt drops on the bare skin of a man. Here we have all the changes that would or might take place in the dog, but we now enter the realms of morality. The man may swear. In fact, he probably will. He may do so in such a way that morally the exclamation is little more than a reflex action; or, yielding to his wrath, he may swear intentionally and blasphemously, or more remarkable still, he may by an act of will control himself and not swear. This last example carries us beyond the lines of the present discussion which refers only to the differences of the living and non-living, but let it stand as emphasizing the truth of the axiom with which we started and hence as showing the essential difference between dog and man.

There is, then, a real distinction between the living and the non-living. This is a strategic position in the battle between dualism and monism. It may indeed be said, and I am entirely of that opinion, that to the sane thinker the distinction is so evident that no one can miss it. But certainly many do miss it, or at least, refuse to see it. If

we believe in a Creator it is perfectly simple that He should have created different categories separated by unbridgeable gulfs; but if everything has blundered along cheerfully from the simple to the complex without Maker, plan or design, it stands to reason (only under those circumstances there could be no reason), that there is no fundamental distinction between the living and the non-living. There is no possible compromise. Either life is something new and different from all that has gone before, or it is not. If the first alternative be the true one then there is something besides matter. There is something suggestive of supernaturalism in living organisms in contradistinction to those which obey only the ordinary laws governing matter. Clearly monism must make a stand here. This is the more heroic from the position being indefensible. It is gratifying to see that of late there has been a reaction from the crass materialism of earlier days of evolution, and that the distinctive nature of vital phenomena has been admitted by some who are not suspected of religion. Indeed, the real enemy now is not materialism, but

pantheism, which mixes up hopelessly the living and the lifeless.

The fundamental fact that living organisms are essentially (not accidentally) different from non-living matter is manifested in part by their structure, but far more by their actions and reactions. The following salient distinctions have been selected for discussion: (a) Difference of structure; (b) Self-motion in the living; (c) Reproduction and growth characteristic of the living, also the process of degeneration; (d) Effect of use on the living, the repair of injuries; (e) Sensation, not characteristic of all living things, but limited to the living.

(a) Non-living matter is the same throughout. There are no constituent parts. Of course different formations may be mixed, as in the familiar "pudding stone," but of each constituent the original statement holds good. In living matter, from the nucleated cell upwards, there are different parts, increasing in complexity, both of the structure of the organs which they form (hence the term "organism") and with the number of tissues of which these organs are composed.

Indeed, we see that these organs are combined into groups with more or less evident functions, and that moreover the various systems act and react on one another. Thus the nervous system requires a blood-supply in common with the rest of the body, and the circulation itself is controlled and modified by the nerves. There is not the slightest trace of any similar arrangement in lifeless matter. Moreover, each living organism has a certain individuality in a way that mere matter has not. Thus a flower is a certain flower and no other. Destroy it and there is a flower the less. The same may be said of a dog, or a mosquito. It might be replied that a stone is a stone, and that if one be crushed into powder there is a stone the less; but a living organism is a whole in the sense in which the term cannot be applied to a stone. What makes it a stone is its chemical composition. Shape and size have nothing to do with it. Wear it down and it remains a stone as long as any of it holds together; but if an animal or plant be torn in pieces it exists no longer, but is replaced by a lot of dead, mutilated frag-

ments which have lost, or soon lose, the nature and properties, even the chemical structure of the original animal or plant.

(b) Living things move of themselves; but the non-living are moved from without. They receive an impulse; they cannot originate one. Of course the living also receive impulses from without. A man may be thrown from a window and may communicate the motion to the man he falls upon precisely as if he were lifeless; but what is quite another thing, he can originate motion, which need not be transmitted externally. In saying that living things move, it is not meant that they change their places, that is as it may be; but the fact that there is action from within manifested only in the inside of the body is the crucial point were it no more than the subdivision of a cell.

(c) Further, living beings reproduce their kind. There is nothing even suggestive of this in the non-living. The wonderful story of the development of the animal from the fertilization of the egg is absolutely beyond all the powers of inanimate matter. The life starts from within and the body develops,

not in size merely like a snowball, but by a complex series of cell divisions, cell growth and cell differentiation by which in the more complex organisms different tissues appear from the cells, various organs arise and group themselves into apparatuses for physiological purposes, first of all for the nutrition of the organism. These changes not only arise from within, but are distinctly purposeful. This is maintained by so distinguished an embryologist as Professor Minot to-day, and indeed was the teaching of Schwann and later of His, the great leaders in that science. As Minot has shown, certain changes which may be considered degenerative appear very early. The rate of growth he shows is continually diminishing. In the earlier stages it is immense, gradually it falls off. Then, during growth we see a change in the structure which paves the way for changes in function, instead of being the result of the latter. The changes throughout early development are of course the most striking, but after complete development there are changes of relative size in the organs, and finally degenerative changes which precede

the close of life. Indeed, degenerative changes of parts begin before the whole organism has reached its even relative maturity. Not very much has been said about these changes, but they are eminently characteristic of the wearing out of the organism. In short, the organism shows its period of development, of comparative stasis at its prime, and of gradual decay, and yet without any sharp boundary lines between these different states, and moreover with the simultaneous manifestation in different tissues and organs of both increasing efficiency and of degeneration.

It has been said that the changes during development, the arrangement of the cells, their change into different tissues, their gradual growth into organs, are distinctly teleological, or in plain English, purposeful. The cells arrange themselves as under the action of intelligence. The growth of lower organisms which can be followed by the microscope is most wonderful, both when all goes on as it should, and still more when, owing either to intentional mutilation or to some accident, something occurs to change the regular course of events. The following

refutation by Hans Driesch¹ of the machine theory is so perfect that it is but just to give it in his own words. "There cannot be any sort of machine in the cell from which the individual originates, because this cell, including both its protoplasm and its nucleus, has undergone a series of divisions, all resulting in equal products, and because a machine cannot be divided, and in spite of that remain what it was. There cannot be, on the other hand, any sort of machine as the real foundation of the whole of an harmonious system, including many cells and many nuclei, because the development of this system goes on normally, even if its parts are rearranged or partly removed, and because a machine would never remain what it had been in such cases."

But not only in growth is the living organism characteristically different from the non-living, but even when worn out it has its own way of degenerating. One very important change seems indeed purely physical, namely, the loss of elasticity in the tissues.

¹ The Science and Philosophy of the Organism, Gifford Lectures, 1907 and 1908.

They stretch just like worn-out rubber bands. In the latter part of life the organs in the neck and chest descend to a lower level in regard to the spine. But other changes are not mechanical. Thus the worn-out muscles do not go to pieces like fraying cords, but their characteristic elements are replaced by those of a lower order: they change into connective tissue. Bone when it wastes preserves its outward shape and the main buttresses of the internal architecture persist, while the weaker ones are absorbed. Is not this absorption to a certain extent protective? As a man uses his limbs less there is the less need of their being strong; and provided they can do their work under ordinary circumstances it is cheaper for the economy to have less weight to carry and less tissue to nourish. Thus life shows method even in its decay.

Some few years ago the yellow journals were full of Dr. Loeb's artificial production of life. If I mistake not we were actually told by the writers that life had been given to the lifeless. It is fair to mention that I cannot remember that Dr. Loeb was ever

in the least responsible for this. His discoveries are startling enough. He has shown that certain cells and low organisms can be fertilized by sea-water and other non-living agencies, and that development will go on for a time. Remarkable and unexpected as this is, it does not in the least affect the fact that life comes from the living only and not from the lifeless.

It was boasted long ago that our laboratories would ere long produce living substances, but they have not done it. *Omnis cellula a cellulâ* is still true till we get back to the first cell of all.

(d) Very characteristic also is the effect of use on the used. The non-living is either broken or worn away by it. The stone rolled for centuries on the beach loses all ridges, a file becomes smooth by using, the magnet loses its power; but, provided always that the external irritation be not so great as to be destructive, the living organism profits by the process, and this, moreover, in many ways. Thus the muscle that is judiciously exercised becomes more powerful, the hands of the worker grow larger and stronger.

Protective changes also appear; the skin becomes fitter to resist pressure under stress of trial. More remarkable still the senses of sight, of hearing, and the rest become more acute by usage. These phenomena in the living body not only imply a something that the non-living does not have, but they are, one might say, contradictory to the effects of use on the lifeless.

But when we pass from these remarkable changes consequent upon legitimate use and wear and tear of the body, to cases of injury or partial destruction, what we see is still more remarkable. This holds good whether the injury be to the developing embryo or to the mature body. It is, of course, an old story that in the lower forms repair is much more complete than in the higher. A newt, for instance, reproduces a new leg in the place of an amputated one. In the higher animals repair is generally effected by the development of a tissue of lower grade than the one destroyed. Thus an injury to the skin is made good by a scar, which serves the purpose of skin as far as protection goes tolerably well, but does not have the hairs

nor glands which normal skin should present. A ruptured muscle is made good by fibrous tissue instead of muscular fibre.

Yet what is most extraordinary is that efforts are made by the organism to carry on an interrupted function by appropriate changes in the apparatus. Let the artery of a limb be tied so that the supply of blood is cut off; the branches above and below the ligature enlarge so that what is called the collateral circulation is established. Someone may say that of course they enlarge by the increased pressure of the blood behind them due to the cutting off of the direct supply, but what is noteworthy is that the arterial branches below the interruption enlarge also, so that there is an obvious effort to reestablish the circulation of the limb. Instead of this occurring one would think it more simple for the arterial blood to go back to the heart as quickly as possible by the enlargement of the capillaries and veins above the injury, thus leaving the limb to its fate; but that is not what happens; there is something providing for the welfare of the whole.

Some experiments by Herbst have shown a wonderful provision (so to speak) for the good of the whole by the adoption on the part of the organism of different methods of repair according to the injury. Thus, if both the eye and the optic ganglion be removed from the crayfish no new eye appears, but if the ganglion be left an eye is reproduced. This is certainly sufficiently wonderful—but it is far short of the whole truth. If both the eye and the ganglion be removed an antenna arises in their place. In short, it being impossible to restore sight, an organ of touch makes what amends it can for the want of the eye. It seems to me that this observation alone is fatal to any materialistic conception of the living organism.¹

I must beg leave to quote again from Driesch's Gifford Lectures. The passage,

¹ A human spine which I placed in the Warren Museum is an unique instance of what must have been an effort at repair of an error occurring very early in development. The front arch of the atlas is wanting, but two bands, which have no representatives under normal conditions, run from the sides of the odontoid to the lateral masses of the atlas, making it secure and allowing motion. It is described in the *Journal of Anatomy and Physiology*, Vol. XXI, 1887.

to be sure, deals in the main with normal development, but it lends itself to a striking illustration of the action of a directing force which must pervade the whole organism when there is need of repair.

“Now you may ask yourselves if you could imagine any sort of a machine, which consists of many parts, but not even of an absolutely fixed number, all of which are equal in their faculties, but all of which in each single case, in spite of their potential equality, not only produce together a certain typical totality, but also arrange themselves typically *in order* to produce this totality. We *are* indeed familiar with certain occurrences in nature where such curious facts are observed, but I doubt if you would speak of them as ‘machines’ in these cases. The mesenchyme cells, in fact, behave just as a number of workmen would do who are to construct, say, a bridge. All of them *can* do every single act, all of them *can* assume every single position; the result always is to be a perfect bridge; and it is to be a perfect bridge even if some of the workmen become sick or are killed by an

accident. The 'prospective values' of a single workman change in such a case."

That is to say that if certain cells are injured their places can be taken by others quasi-intelligently and doing other than the work which would naturally have fallen to them. But Driesch might have gone further and have supposed that some accident had happened to the bridge in the course of construction and have told us that then these same cells would have rearranged themselves and have made, if not the contemplated bridge, at least a very tolerable substitute for one. Instances might easily be cited of the behavior of the bony tissue after a fracture, say of the neck of the femur in which the architectural design is repaired with adaptation to the new conditions. Surely this is more than the work of a machine; but, what is at this moment more to the point, it is more than the work of a very large number of cells. Even if we yield ourselves to the absurdity of calling the cells intelligent we must admit that this is not enough. Let us suppose such an accident happening to an actual bridge with an army of workmen upon

and about it. How in the world will they start without consultation to repair it? Who will decide what is the proper plan to adopt? Who will tell each man what to do? It takes little imagination to see that without a leader the result would be fatal and hopeless confusion. If a leading spirit would be necessary for men, how much more so for cells. Now this guiding power cannot be material, for it pervades the whole. This it is that presides over development, growth, repair. In the mineral kingdom we find indeed one set of phenomena which resembles these shown in the process of repair in the living. It is manifested in crystals in process of formation which when injured are not only repaired, but repaired in more than one way according to circumstances. The analogy with vital processes is very striking; but after all it applies to but one of the manifestations of life.

(e) We have so far considered the structure and action of living things as they can be observed by the naked eye or by the microscope. We come now to something higher, to sensation. We need not discuss

which are the lowest organisms that feel; we know that feeling belongs to organisms only. While it is not true that everything that is alive feels, it is true that everything that feels is alive. Sensation being a bodily function there must, of course, be an apparatus for its exercise. But beside and superior to this there must be a non-material something which receives the impressions on the apparatus and recognizes the sensation. It is hard to prove a negative, and yet this seems to be precisely what is expected of vitalists. If I am told that a stone suffers from nausea while rolling downhill, what can I say in reply? I can only say that so far as we know sensation requires an apparatus which is not found in the stone and further that no signs of nausea have been observed. Moreover, common-sense (*pace* Fechner) tells us that the idea is absurd.

To those trained only in the physiology of the day the necessity of admitting the non-material element will be far from apparent, but this necessity becomes clear enough when we try to explain sensation without it. Let us suppose that an impres-

sion being made upon a group of nerve cells each one of them enters into the impressed condition and feels the impression made upon it. To be sure we do not know any too well just where impression becomes sensation, but supposing the case to be as just stated, each cell can feel only the impression made upon itself and can know nothing of the impressions made upon its neighbors. It is as if each member of an audience in a concert hall heard one note of the music. The air indeed has been rendered, but who has heard it? Again we may suppose that each cell of the retina can see what is in the ray of light falling upon itself and can see no more. The landscape is there; but who sees it? It does not help us to say that the nervous system can concentrate the impressed condition of many cells upon a smaller number, for even if we could bring all the nerves to a single cell, yet that cell, being extended, has parts, and each part can perceive at most only the impression made upon itself. Thus we must insist that there is a non-extended, immaterial element, which governed by other laws than those of matter, receives, as a whole, the im-

pression on the sensory apparatus. Putting together all these peculiarities of living matter, we see that they all show the presence of a something absolutely unknown to the non-living. It is something that gives the power to grow, to regulate the repair of injury, to reproduce other individuals and in the higher organisms to experience sensations of various kinds. This principle is so intimately associated with the matter of a living organism that it takes the two together to make the organism what it is. In other words, the two make the whole and the organism cannot exist without both. This principle is the "form" of Catholic philosophy. Driesch would call it entelechy. I prefer to call it the vital principle as more intelligible to the man in the street; but I mean by this precisely what the Scholastics mean by "form."

The question is raised whether the vital principle, the form, or whatever you call it, merely directs the ordinary forces or is in any way a force in itself. Of course the mechanical forces could not of themselves bring about the wonderful changes shown by a developing organism. But with this vital

principle to guide their action is it necessary to assume that it is a force in itself? It is impossible to see how the ordinary forces could account for the cell divisions of the fertilized egg and the formation of the embryo. This was recognized by His, the great embryologist. Driesch goes so far as to say that "we must be cautious in admitting that any organic feature has been explained, even in the most general way, by the action of physical forces," and points out that "what at first seems to be the result of mechanical pressure may afterwards be found to be an active process of growth."¹

Certainly the vital principle is an influence, not only originating, but directing and controlling force; yet it can be shown that purely mechanical forces play their part. A very interesting and simple illustration is furnished by the changes that occur in the angle between the shaft and the neck of the human thigh-bone. At birth the neck forms an angle of 160 degrees, which diminishes rapidly in the very first years of life, evidently owing to the weight of the body pressing upon it as the

¹ Yet he holds that entelechy is not energy.

child stands and walks. In proof of this is the case of a child mentioned by Humphry who had so immense a head from water on the brain that the poor creature was never able to stand, and at its death, at five years, the thigh-bones retained the angle of an infant at birth. So much in proof of the mechanical action of the weight; but why is it that when the proper shape is reached in a normal bone there is no further pushing down of the neck of the femur? Having reached its proper position it stays there; something resists the pressure before which till then the growing bone had yielded. Probably this is brought about by the internal structure of the neck. Professor Humphry spoke of "an harmonious antagonism between the formative and mechanical forces." Very certainly this harmonizing of opposite strains is a fact that pure mechanics will not account for. I conceive it to be one of the functions of the vital principle.

The following instance, also from human anatomy, is a more striking one. I shall try to make it intelligible to those who are not anatomists. The pneumogastric is a great

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nerve extending from the base of the skull through the neck down into the thorax, in the upper part of which the right one passes in front of the subclavian artery, which is an important vessel arching over the lung near its apex and passing out under the collar-bone to supply the right arm with blood. As the nerve passes this artery it gives off a branch, the recurrent laryngeal nerve (so called from its course), which, hooking under the vessel, passes backwards and then upwards to the larynx, the organ of voice in which it supplies most of the muscles of the right side. Now it seems surprising that as the pneumogastric passed directly beside the larynx in its descent, the branch is not given off at the level of the larynx instead of having to take this retrograde course. The answer is that in the early stages of the embryo the heart is situated very much higher than later (in fact it is very near to the head) and that the nerve in fact passed to the larynx below the arterial arch which later forms the right subclavian. As the heart descends to its permanent place the arches descend with it and the nerve is drawn down

by the arch so that to reach its destination it has to travel upward. This is the usual explanation and there is no doubt that it is the true one, for in certain cases in which the right subclavian artery develops in an abnormal manner so that the arch is not formed across the laryngeal nerve, the latter passes directly by the shortest way from its parent trunk to the larynx. This seems conclusive that normally the nerve is pulled down. But note what happens in the adult when a swelling of the subclavian artery (aneurism) presses on the recurrent nerve as it passes under it. The nerve is disorganized by the pressure so that paralysis of the muscles supplied by it is the result. Now the displacement of the nerve by this swelling is insignificant compared to that resulting from the change of position during development. Moreover, in the adult the nerve is protected by fibrous tissue, while in the early embryo it is little more than a chain of cells, yet they resist the strain. This pulling down of the nerve is confirmed by the fact that it takes another course when there is no strain upon it, while under usual circumstances it

allows itself to be dragged. The only explanation conceivable is that the delicate cells of the developing nerve yield, as it were, willingly to the pull of the artery, while in the adult they perish under the pressure of an abnormal swelling.

A difficulty, at first sight a serious difficulty, which presents itself to the theory of a vital principle, is founded on the well-known facts that the hair may grow after death and that certain actions persist, even after the dismemberment of the body. The heart of a turtle will go on beating when cut out and hung up. It has not been started anew; it goes on. The explanation of these phenomena is simply that what is truly a vital action may under certain circumstances continue for a time (and only for a time) after the life which started it has ceased to exist. Will some one who demurs to this make us a heart which will contract of itself? Or if the material be not at hand will he tell us how it should be made?

Having thus admitted a vital principle, it is but reasonable that we should expect to be called upon to define life. It is not easy.

Among modern definitions I know none better than that of Herbert Spencer: "The continuous adjustment of internal relations to external realtions," and yet it is far from satisfactory. It assumes that external relations come first. It would be very hard to prove that the progressive changes in the developing embryo are in any way influenced by external relations. It will not do.

The scholastic definition is brief and to the point: "immanent action." That is action originating within and persisting within, consequently action arising from a non-material force. One cannot help desiring a rather more comprehensive definition; but anyone who will try to add to this will soon be only too glad to leave it alone.

Of course some one will say that the terms vitalism and vital principle are merely terms cloaking our ignorance. If so the same must be said of gravitation and electricity. Who ever saw them? We have seen in living bodies phenomena which physical forces cannot produce: therefore we are wholly in our right in declaring them the result of a certain force which we find acting in living

organisms. It is very gratifying to see how much progress the cause of vitalism has made in the last twenty years. It is no longer merely Catholic, but is winning its way towards general acceptance. One school, and unfortunately the prominent one in the eyes of the ignorant, refuses it utterly: and from its very nature must do so. It is that of "the mountain," if I may again take a figure from the times of the French Revolution. Weismann, one of its orators, speaking of natural selection, after declaring that we must accept it although we cannot prove it, continues: "just as the view of modern physiologists that there is no peculiar vital force is not negatived, though to this day we cannot explain even a single vital process by purely physical forces."¹ Such language, indeed, tickles the ears of the *sans culottes* of science, but is beneath the contempt of the man taking reason for his guide.

Life, then, being due to the vital principle or "the form" of scholastic philosophy, we should wish naturally to know where the latter comes from. It is one of those ques-

¹ *The Contemporary Review*, 1893, p. 337.

tions which experiment does not help us to answer. All that observation tells us is that the fertilized ovum shows vital processes from the very start.

While it is evident that the vital principle of a cabbage is of a lower grade than that of a lobster, and the latter than that of an ape, yet it does not seem impossible that each may possess the property of rising in the scale of being, and that thus evolution should come to pass. But what is the origin of the first vital principle of all? Can it by any possibility have been evolved from the non-living? It is very dangerous to predicate of the absolutely possible and impossible; but remembering that its activities are entirely different from and superior to anything that lifeless matter shows us, we know that it must be a new creation. The living and non-living are separated by an unbridgeable chasm.

VII

MAN

Synopsis.—Man a rational animal. The body differs from animals only in degree. The essential difference is in the spiritual soul which cannot have been evolved. Man as a mere animal not a success. The body may be the result of evolution. The origin of Eve. Anatomical peculiarities of ancient and of lower races. Criminal anthropology. The probable existence of a criminal type. Moral degradation not a return to the beast.

THE usual so-called scientific definition of man (but I am not speaking of true science) is that he is nearly allied to the anthropoids, differing only in degree both bodily and mentally from other animals. Whether he have a soul or not may perhaps be left undecided, though the weight of evidence is against it. In any case there is no radical psychological distinction from animals.

According to Catholic doctrine man is a rational animal, a composite of soul and body so united as to form a single substance. It is the spiritual immortal soul which makes him

*is soul
substance*

what he is. In scholastic language it is the "form" of the body. While the soul can exist without the body it is not in itself complete man; hence the necessity of the resurrection of the body that the complete individual may exist forever in that sphere in which God's justice shall place him.

Let us turn our attention first to the body. It differs in degree only from that of apes and monkeys, resembling one species more closely in one respect and another in another. As will be shown in another chapter, we are quite at sea as to any line of descent. If we compare the individual bones with those of apes we cannot fail to see the correspondence. In some instances the resemblances are remarkable, but this is not common. If we examine the skeleton as a whole we note the following striking differences, although even some of these are not quite universal: the large brain-case and the small face and teeth, the fitness for the upright position, with the necessary curves of the spine, a foot which is more of a support than a prehensile organ, the capability of straightening the spine so as to throw back the head while the leg is straight

at both hip and knee and the foot at a right angle; the relatively long lower extremity compared with the upper; the relatively short hands and feet compared with the rest of the limbs. To these some would add the large thumb; but to me it seems merely a detail. If we examine these features one by one we find none of them of great value. The most striking is the large size of the skull compared to the face, in which respect the difference between man and the apes is very great, while curiously enough it is much less in some small monkeys. Proportions become the more confusing as guides the longer you follow them. Thus among apes and monkeys some are found with a longer leg compared to the length of the spine, and some with a shorter hand compared to the length of the arm than is the case in man. The upright position is certainly one of the great human characteristics, but I am not carried away by the enthusiasm with which some authors dilate on it. Aristotle wrote that man alone is upright because his nature and substance are divine; but after all, his nature and substance are not divine, and if they were what

then? I once wrote that if it had pleased God to inform the body of an eagle with an immortal soul, undoubtedly the aquiline philosophers would have proved from the strong flight and unflinching gaze the paramount nobility of the body and the eminent propriety of the choice. I did not know that the same idea had been worked out a little differently by a French anatomist two hundred years before. Birds hold their heads erect with a graceful backward swing of the neck which man cannot imitate, what matters it that they cannot straighten the hip and knee at the same time? So much for the bones; if we were to go through all the other systems we should find no single feature in man's body that can claim to be absolutely characteristic. Some small monkeys have even a heavier brain relatively to the body than man has. The difference is of degree and of degree only. It is true enough that the gap between man's body and that of any animal is a very great one, and that no system of evolution gives us any reliable evidence of intermediate steps in a direct line. Huxley probably went too far in maintaining that

there is a greater difference between the bodies of the lowest and of the highest apes than between the latter and man; but, after all, who cares? The difference is only one of degree, and the size of the degree is of very secondary interest.

The studies to which the doctrine of evolution gave rise have added very much to our knowledge and understanding of the human body. Time was when some good souls thought it almost beyond the line to believe that it contains useless structures. Now no one doubts it. We have also got through with quite absurd explanations of structures as serving for ornament because they could not be accounted for as useful. The microscope has done away with the superior delicacy, whatever that may mean, of the human tissues. Points of resemblance of the human body to that of lower forms will be considered later in another connection. The proposition before us is that man is not essentially different from animals if the inquiry is limited to his bodily structure. This view is much strengthened by the fact that in the matter of variation man's body behaves precisely

like that of an animal. We find in both occasional departures in point of detail from the normal condition often representing what is normal in other species. A recent discovery in the field of blood-reaction shows a close resemblance physiologically between human blood and that of the higher apes.

We now turn to the real distinctive feature of man: the human soul. I have attempted to show that a vital principle is necessary to account for many of the phenomena observed in living organisms which are quite different from any of those observed in lifeless matter. This indicates a break in any line of ascent; but another and even a greater one comes when we pass from beast to man. The vital principle of man is his soul; radically different from that of animals inasmuch as it is spiritual and immortal. In proving that it is the soul which makes man what he is philosophy bears witness to the truth of revelation.

The gist of the distinction between the human and the animal soul is that the latter has no general ideas. To be sure, as I believe Mivart said, the cat has an idea of "mouse"

quite irrespective of any particular mouse; but it is a vague, and one may say a concrete, not an universal idea. The cat cannot tell what constitutes "mousiness." There is nothing in the animal in the least corresponding to the concept of God, of religion, of space, of eternity, of right, and of love. Many beasts show an instinctive love for their young, while they are young, which is replaced later by the most complete indifference. Man not only knows and thinks; but he *knows* that he knows, or if he has lost his bearings, he *thinks* that he does not know. His mind is capable of turning its light inward upon itself and of analyzing its workings. The animal may be trained by kindness or by fear to obey its master; but it is quite incapable of the idea that it might be its duty to a higher law to disobey its master. Man alone can consider two opposite courses of action and deliberately choose the one and reject the other. There are those who tell us that this freedom of the will is a delusion, and that unconsciously but necessarily the more attractive course is chosen. But who that has ever resisted a temptation after a mental

struggle does not know better? Universal usage throughout civilization (and indeed in uncivilization) tells us that in every detail of intercourse among men we recognize the existence of free-will. The state of mind that denies it is not one of enlightenment, but of muddleheadedness.

But I am anxious not to understate the difficulties of the subject. St. Thomas Aquinas¹ says that there is some likeness of reason in animals. We have all seen or heard of instances of actions by brutes which seem to have been dictated by reason. We can convince ourselves that the moving power is not reason; but it is something so like it that we despair of convincing anyone who disagrees with us. The strongest demonstration of the fact is, however, precisely by the line of argument that would be dearest to many an opponent. It rests on the assumed minute and gradual changes from the living cell up to man, or from man down to the cell. His boasted reason merges into instinct, instinct into reaction to a stimulus; "*quod erat demonstrandum*" triumphantly exclaims my adver-

¹ De Veritate, quæst. 24, art. 2.

sary. But here I protest: "*Doch ein Begriff muss bei dem Worte sein.*" The term "reason" must mean something and something definite; but here we find the monists following precisely the advice of Mephistopheles: that really one must not be too particular, for when ideas fail us a word steps in just at the right moment. But here it is not so much the question of the word stepping in, as of its stepping in disguised. The word "reason" is used in the most unreasonable way; the idea of reason being hopelessly confused with that of instinct or tendency. When we are told that plants have intelligence we can only say that the author of the statement has his own idea of what intelligence is. Why should he not go a step further and say that some plants have religion because they turn their heads to the sun? The general teaching of experts in the study of animals like ants, bees, and wasps, which have very highly developed instincts, is that they show no signs of reason when they find themselves under strange conditions. Reason, involving as it does general ideas, can by no possibility have been evolved.

The Church teaches that each human soul has been created. Reason tells us that, as far as we can see, there is no other way to account for its origin. *only that it has always existed*

Let us now look at man as a whole. Huxley once recommended that we should study man's body as if it had been sent us from another planet "preserved, it may be, in a cask of rum." He then pointed out what I have stated at length, that all bodily differences between man and apes are merely differences of degree. The incident seems to me a very striking evidence of how much friend and foe alike have over-estimated Huxley. Surely it takes no great talent to see that to place any being correctly in the scale of creation (or if you prefer in that of nature) it is necessary to study and classify him as a whole. Suppose a bee, or an ant, or a wasp had happened to fall into that same cask of rum, should we have had any hint of their wonderful instincts from our examination of their dead bodies? Of course we are told that Huxley meant to discuss only the body and place it in its zoölogical position; but it is getting recognized that this is a very narrow

and one-sided view to take of any organism and, above all, of so high an organism as man, whose intelligence (be its origin what you will) places him in an order of his own. The problem is of a higher sphere than that of morphology.

None the less, let us look at man anatomically. I have mentioned his chief characteristics and it is not necessary to enlarge the list; but let us consider his body as a whole. There is the very large cranium in proportion to the face, which we find far exceeds that of the higher apes; yet by no means so strikingly, some of the smaller American monkeys. When we examine the relative weight of the brain to that of the body we find that in some of these monkeys it is even greater than that of man. Not very strong of arm, not very swift of foot, without a well-developed hairy hide, or large teeth, or strong claws, he seems as a mere animal an exceedingly unfortunate one, good neither for attack nor defence, in short, very unfit for the struggle for existence, in that imaginary period of half-fledgedness between brute and man. His instincts and his senses, that of touch perhaps excepted,

though in the savage state undoubtedly greater than those of civilized man, are by no means remarkable. Take him as a mere animal, what is he but an egregious failure? By what kind of evolution could such a creature rise who shows throughout his body only instances of the survival of the unfittest? Let us try to imagine him rising in the scale according to the dogmas of evolution. Let us watch the arboreal monkey well fitted for his surroundings gradually losing all that fits him for them. We see his coat growing thinner, his arms shorter so that he loses his "reach," his legs longer so that climbing becomes harder, and at the same time his brain growing in some incomprehensible way, and for no good reason, excepting that it is necessary for the theory to believe that the brain-development went on so swimmingly that it compensated for the physical degeneration.

But even if we admit that some fortunate clan of monkeys managed to raise itself by mutual improvement so that while the tail was withering, and the brain swelling, they began to make fires, and acquired ideas by dint of talking, developing respect for what

was not clear till it amounted to awe and became religion; we cannot deny that this wonderful series of changes must have extended over unknown but very long periods of time. Very vast numbers of individuals must have taken part in the pageant which cannot have been hid in a corner. Have we not a right then to expect something better in the way of a "missing link" than the Trinil skeleton, even if we admit that the skull and the femur, found some fifteen metres apart, belonged to the same individual? In point of fact when we come to imagine, and this is in the field of imagination, the development of psychical factors we find ourselves very much as if we were making a trip with "Alice" into "Wonderland." It is very evident that no process of survival of the fittest could have led to higher ideals of conduct, for, so far as we can see, not only in the savage world, but in the cultivated world of to-day, the survival of the fittest has by no means implied the survival of the highest or the best. Huxley himself admitted that when we come to these ethical questions, this theory of the survival of the fittest, far from being a help

is a hindrance. Most certainly if self-preservation be, as it must, the guiding instinct in animals, every step towards love of the neighbor and self-sacrifice must tend to the elimination of the individuals suffering from these advanced feelings. Indeed even in the highest civilization, if this world be the end, every step in morality would imply the survival of the unfittest. The evolution of the soul is untenable as a scientific proposition.

But what of the origin of the body? Was that of Adam a new creation, or was it evolved from lower forms? There is no denying that many assume the latter theory and use it as a working hypothesis whether they really believe it or not. Catholics have done so upon the understanding that the question is an open one. A much stronger argument than that of mere resemblance is furnished by the facts I cited a while ago: that the body varies in the same way as those of animals, and that the blood of man and of the higher apes has a similar reaction. Now on the theory of special creation these analogies are extremely hard to account for. They certainly seem to imply a relationship; and

yet we must not forget that one of the greatest errors of the naturalists of to-day, against which I am continually protesting, is that similarity of structure necessarily implies relationship, and if this be true in the case of structure why not of function. If we accept evolution by leaps, and the leap is not an inordinately long one, we might absolutely admit some basis of a possible conjecture that man's body could have come from that of some lower animal and could have been made human when God, in the language of Scripture, "breathed into it the breath of life," or in other words informed it with an immortal soul.] However, the great majority of conservative Catholic theologians consider this hypothesis as unwarranted, partly on the ground that such an origin is unworthy of the dignity of man, a being destined to immortality, and whose soul is in the image and likeness of God. For many years I was puzzled as to the justice of this objection, of which I trust I fully appreciate the weight; but now I feel more and more inclined to respect it. I am free to confess that for a long time my mental state resented any too dic-

tatorial statement regarding the origin of the body of man, but the solution of this mystery in harmony with the theory of evolution, as I shall show in another chapter, is founded upon principles mutually exclusive from a morphological point of view. So till we have a theory which can boast of some plausibility we had better set aside the problem of the origin of the human body from a purely scientific point of view as a merely academic question.

The anatomy of savage and prehistoric races gives but weak support to the theory of the evolution of the body. The general views of the descent of man and of the human variations representing animal features are discussed elsewhere. Suffice it to say in this place that there is no satisfactory "missing link." The Trinil femur is very human, and the skull, beyond question, is higher than that of any known ape. Assuming, what is by no means certain, that they belonged together, the creature is ape and not man. A find that is considered of perhaps equal importance is that of the "Heidelberg jaw" although unfortunately it is a jaw and nothing

else, which was unearthed in 1907.¹ In a few words it may be described as the jaw of an ape with the teeth of a man. There is no prominence at the chin, and the ascending portion (the *ramus*) is very much broader than that of man. The teeth resemble human ones, but are too small for the jaw. It is not the jaw of any known ape, resembling both that of the gorilla and that of the gibbon. Why so massive a jaw should have such inefficient teeth is hard to explain, for the very strength of the jaw implies the fitness of corresponding teeth. Either it is an anomaly or the jaw of some aberrant species of ape. The Neanderthal skull, on the contrary, is presumably human. It is a fine specimen of a very low type of which less well-marked instances are not excessively rare. In 1908 Hauser² found in the lower cave of Le Moustier in the Valley of Vézère the skull of an adult and the skeleton of a youth presenting distinct ape-like features in the limbs, both of which are assigned to the same race.

¹ Otto Schoetensack: *Der Unterkiefer des Homo Heidelbergensis*, Leipzig, 1908.

² H. Klaatsch and O. Hauser: *Homo Mousteriensis* Hauseri. *Archiv für Anthropologie*, 1909.

Other finds might be mentioned, to say nothing of the new Aurignac race¹ (of which but a single specimen has been seen), which is held to be somewhat higher than that of the Neanderthal.

The various races of men show occasionally ape-like features, but in very different degrees of frequency, and most commonly in what we call the lower races, whether those of to-day or the prehistoric ones. Yet, as will be shown elsewhere, these peculiarities cannot be brought to give concurrent evidence for any scheme of human descent. Thus the perforation of the humerus just above the elbow, so common in apes as perhaps to deserve to be called normal, is found very rarely in civilized countries to-day: I think in not over 3%, though Topinard (from whom I take the following figures) puts it at from 3% to 5%. In the stone age it was found in about 10%, always excepting the region around Paris, where it was found in 21%. It occurs in the Canary Islands

¹ H. Klaatsch: Die Aurignac Rasse und ihre Stellung im Stammbaum der Menschheit. Zeitschrift für Ethnologie, 1910.

in 25%, in yellow races and Indians in 36%, in Polynesians in 34%, in Mound-builders in 31%, and, according to Wiedersheim, in the Weddas in 58%. Thus it clearly is very much of a racial peculiarity, but it would hardly do to draw up a scale of human races in accord with its frequency. The dissecting rooms of a large city show a great range of peculiarities, by which I do not mean so much variations, discussed in another chapter, as instances of different types of bones. Moreover, these occur, not only in mixed populations, but in comparatively pure races.

The bones of the leg are very interesting in their variations. Thus there is a form of thigh-bone termed "pilastered" from having the ridge along the back considerably enlarged while the bone itself is bent more than usual. Now this is very common in savage and ancient races, while it is rare among civilized men; yet the peculiarity is not an ape-like one like the perforation of the humerus, for the femur of the ape is quite different. Thus all peculiarities of antique and lower races do not point to a simian

ancestry. The shin-bone is often very thin in the same races that present the "pilastered" femur. The French compare it to a sabre, naming such a bone a "*tibia en lame de sabre*." This generally, and probably correctly, is regarded as an ape-like feature, and in man is found chiefly in the old and savage races. It is plausibly explained as due to the mode of life and to the pressure of a great muscle in the back of the leg, which modifies the shape of the bone. Be that as it may, it is certain that, like the pilastered femur, it still occurs quite irrespective of function. The frequency of the appearance in the same leg of an ape-like tibia supporting a femur far removed from the ape-like pattern is worthy of serious thought. Every shape, both of femur and tibia, is found in our dissecting rooms. I was very much struck on finding the greatest contrast between the bones of the legs in the bodies of two well-shaped men (if I remember rightly both in the prime of life) lying on adjacent tables. Had they been picked up in widely separated countries they might have plausibly been referred to different races. Long ago when evolution

was cruder than it now is we were given to understand that the head of the shin-bone was so strongly thrown back in certain antique skeletons that the individuals had not yet quite acquired the upright position. Now we know that this feature, which certainly is an ape-like one, implies simply that the race was one of those with the habit of "squatting," which implies that the body hangs from the knees, not touching the ground, for hours together. As a matter of course we look for this in savage tribes.

Before leaving the tibia I should like to call attention to a very curious fact brought out by Herdlicka¹ in an elaborate study of this bone in different races, namely: that in a considerable percentage of Africans this bone shows the general shape and proportions of the tibia of the gorilla. This is evidence of a law yet to be worked out, according to which the flora and fauna of a country present a certain general resemblance in their characteristics which may be compared to a family likeness. Now the American Indian

¹ Study of the Normal Tibia. *The American Anthropologist*, October, 1898.

bones examined by Herdlicka showed no single instance of this shape. No one will now say that the African descended from the gorilla; but it is in the home of the gorilla that this peculiarity is most frequently observed. Clearly some other force than heredity is of importance in these morphological problems, unless indeed there should be overwhelming evidence in favor of Klaatsch's contention that both come from a common stock.

There is another view of this whole question which deserves respectful consideration, though it is so at variance with the influence of the *Zeitgeist* that little is heard of it. May it not be that many low forms of man, archaic as well as contemporary, are degenerate races? We are told everything, and more than everything, about progress; but decline is put aside. It is impossible to construct a tolerable scheme of ascent among the races of man; but cannot dark points be made light by this theory of degeneration? One of the most obscure, and to me most attractive of questions, is the wiping out of old civilizations. That it has occurred repeatedly, and on very extensive scales, is as certain as any

fact in history. Why is it not reasonable to believe that bodily degeneration took place in those fallen from a higher estate, who, half-starved and degraded, returned to savagery? Moreover, the workings of the soul would be hampered by the degenerating brain. For my part I believe the Neanderthal man to be a specimen of a race, not arrested in its upward climb, but thrown down from a higher position. We have been told, I believe by Max Müller, that there are few if any of the most degraded races of mankind whose language does not suggest a larger vocabulary than the one now in use. Herbert Spencer speaks in his *Sociology* of the degradation from something higher of most, if not of all, the savage tribes of to-day. None the less there is the great objection to this view, the importance of which must not be denied, that the Neanderthal race was an excessively old one and that skeletons of the higher race which, according to the view I have offered, must have existed at the same time as the degenerate ones, are still to be discovered.

There is, however, one phase of degenera-

tion, which at least for a time received all the attention it deserved. One of the most curious episodes in the history of science in the nineteenth century is the rise and fall of Lombroso's school of criminal anthropology. A product of ultra-materialistic thought, it had the support of the extremists. I think it was Lombroso himself who asked: "*Est-ce que la vertu comme le crime, ces deux extrêmes, ne sont pas des exceptions, des anomalies?*" I fail to remember that he ever attempted any demonstration of a virtuous type; but his criminal type was for a time a great success. The key-note was atavism, used as nearly synonymous with degeneration. Dr. Morris, editor of the Criminology Series, summarized Lombroso's contention so concisely that I cannot do better than quote him: "The criminal population as a whole, but the habitual criminal in particular, is to be distinguished from the average members of the community by a much higher percentage of physical anomalies. . . . In short the habitual offender is a product, according to Dr. Lombroso, of pathological and atavistic anomalies; he stands

midway between the lunatic and the savage; and he represents a special type of the human race." The anomalies and peculiarities most relied on are a low and hairy forehead with prominences under the eyebrows, a large lower jaw, protruding and ill-shaped ears, left-handedness, asymmetry of head and face, and the wormian fossa, which is a depression in the interior of the base of the skull below the cerebellum. The value and significance of some of these signs is open to grave question. While, for instance, the ears of apes stand out strongly from the head, the adherence of an ear is not normal in apes, yet it does duty just the same as a sign of degeneration. Wormian bones (bones found in the lines of union of the bones of the skull) are very common in the skulls of criminals, and also in those of the insane; but they are not rare in the skulls of those who are neither. They indicate an irregular process in the ossification of the skull, and, according to some, are rachitic; thus, if very numerous, they may be considered at least as pathological; but this is not the same as admitting that they prove

degeneration. The vermian fossa is probably the one of the alleged criminal stigmata, concerning which there has been the greatest discussion. It was once thought to depend upon the over-development of the middle lobe of the cerebellum, but there is little in support of this view. Lombroso found this fossa in 16% of male criminals, in 13% of assassins, in 28% of thieves, and in 75% of female poisoners. This is a very instructive example of what wonderful results can be obtained from small series. Debiere found the fossa only 8 times among 361 skulls of criminals. Left-handedness, according to Lombroso, is very common among criminals. He found it in 14.3% of male, and in 22.7% of female criminals; while he gives the percentages among honest men and women as 5.8 and 4.3 respectively. On the other hand, Baer found only 1.06% of 1,004 prisoners left-handed and that 5% could do their work with either hand. The heavy lower jaw of criminals, according to Manouvrier's observations, is really both absolutely and relatively (in regard to the face) heavier than in average skulls.

The low forehead, the heavy jaws, and the relatively large size of the back of the head give altogether rather a characteristic criminal appearance; but without going into an anatomical discussion, one may say that it has been pretty well established that Lombroso's criminal features, considered one by one, do not fulfil the expectations that had been formed of them (this is particularly true of the vermian fossa) and that his theory has lost ground. It should not be necessary to remark that, quite ignorant as we are of the steps of man's alleged ascent from apes and monkeys, we are not justified in considering any ape-like feature we come across as the result of the reversal of the ascent and in prating of atavism. All we can say is that the man in this or that respect looks like an ape. We should not forget that, as Gudden pointed out, while a perfectly built skull presupposes a perfectly built brain, yet the converse is not proved, namely: that a deformed but a well-compensated skull (one in which the deficient room in one part is made up for in another) cannot lodge a perfectly well-working brain.

The criminal type, according to its discoverer, is found in only 25% of adult criminals, murderers and thieves giving the highest percentages, but it may reach 58% in younger ones. Topinard asked what we would think of calling a race short-headed of which 60% have long skulls. I do not think that this criticism is a fair one. There may be a criminal type very distinctly marked, especially among habitual (may we not say congenital?) criminals, although it may not appear in the majority of so-called criminals; a term, by the way, which it is not always easy to apply correctly. Malefactors vary like other people. Many can recall persons who might be cited as instances of almost total depravity whose appearance was far from unpleasing; but these are the exceptions. In the collection of variations of bones in the Warren Museum of the Harvard Medical School there are three skulls of murderers. One of them, that of "Marchant" who cheated the gallows by suicide in the first third of the last century, would have rejoiced Lombroso's heart. There are the low forehead, the heavy lower jaw, the over-develop-

ment of the hind part of the head, marked unevenness of the face and a vermian fossa. I do not think it is imagination which makes me see in it one of the most brutal human skulls that I can remember. But the skull of the murderer next to Marchant's is wanting in every one of these features that make his skull a typical example. The third skull, belonging to one of the far-Eastern races, cannot properly be compared with the other two.

Though Lombroso's criminal type has lost credit, and although his explanation by atavism is quite unfounded, I cannot but feel that we are going too far in rejecting the idea of a criminal type, even if it be pronounced in but a small proportion of criminals. I believe that undeniable physical signs may be so grouped in the born criminal as to supplement one another; but I cannot go so far as Lombroso in saying that they *are* so grouped. The number and importance of these signs may vary, but they undoubtedly have a significance. Baer, the able author of *Der Verbrecher*, believes that these signs are not the specific marks of a criminal, but only

degenerative features appearing in the lower grades of the population, which, of course, include the so-called criminal class, and that they are due only to the inferiority of the organism. This may be very true, and perhaps it would be better to believe that they are signs of lowness rather than of crime; but unfortunately lowness and crime go together to such an appalling extent in the "submerged tenth" (I am not speaking of the decent poor) that, while there may be a distinction, there is practically no difference. Degenerates can and do have a family likeness which is characteristic of their relationship in crime. Anomalies occur most frequently in all probability, not to say beyond question, in degenerates. These are the lowest of the population and among them from the very nature of the case crime is most common; add to this a strong hereditary tendency, and it is but natural, precisely what one should expect, that the criminal features should persist and even become accentuated in the unfortunates who cannot remember the time when their bodies were sound or their minds pure. I need not

repeat the thrice told tale of the Jukes, criminals for generations. Dangerous guide as physiognomy may be, we cannot believe that the instinct of the world is all wrong in associating certain casts of countenance with crime. Bulwer's description in *Pelham* of the miserable beings crowding around a gin shop is very suggestive. He depicts a general expression of eager, envious, wistful anxiety which predominated so far over the various characters as to communicate a common likeness to all. "It was as if an impress of such a seal as you might imagine, not the arch-fiend, but one of his subordinate shepherds, would have set upon each of his flock." That the faces are bestial is admitted; but that this is due to a retracing of evolutionary steps is mere imagination.

There is another allied aspect of fallen man which must at least be glanced at, dark and repulsive as it is. Let anyone consider the refinement of vice in the cruelty, lust and luxury of the Roman Empire and of Oriental despotisms (for very shame's sake we shall look no nearer home) and he will find in it a malice very different from mere savagery.

The cause lies deeper than in the survival of animal passions; it is far more suggestive of a fallen angel revelling in evil. It is not the return to a lower state, but the corruption of a higher. Chesterton says truly: "Man is always something worse or something better than an animal."

VIII

THE DESCENT OF MAN

Synopsis.—Apes and monkeys, the Neanderthal skull, the Trinil skeleton (*Pithecanthropus*), Hæckel's scheme of human descent. Schwalbe's views, Kollmann's pygmies, Aeby on the skull. "Convergence." Haacke will have no intermediate form between man and apes. Hubrecht, Klaatsch, Alsberg. Ranke on individual differences of the skull. Which are the higher races? Kohlbrugge declares we have not even seen the face of evolution.

WE come now to consider the various theories of this alleged descent, putting aside for the present all psychological considerations and dealing only with the body.

Dr. Kohlbrugge,¹ apart from his merits

¹This chapter is moulded on a review by me of a work of some one hundred pages by Dr. J. H. F. Kohlbrugge, entitled "*Die Morphologische Abstammung des Menschen. Kritische Studie über die neuen Hypothesen, 1908.*" (The morphological descent of man; critical studies of the more recent hypotheses.) The review appeared in the *Anatomical Record*, Vol. II, 1908.

Although this chapter has been rewritten with both additions and omissions, I have found it best to keep it in the form of a review of Kohlbrugge's work.

as a student of anthropology and comparative anatomy, is a strong writer and an independent thinker. He published in 1897 a small pamphlet entitled "Der Atavismus." It was a very severe criticism of the theories and speculations of men who stood high in science. In the present work he points out that evolutionary thought has drifted considerably from that of Darwinian times, and gives a series of sketches and criticisms of the work of the most prominent students of the day.

For the convenience of those not versed in comparative anatomy¹ I shall here say a word, in parenthesis as it were, of the lemurs, monkeys and apes, which together with man (anatomically considered) constitute the order of the *primates*. The *anthropoid apes* are the *chimpanzee*, the *gorilla*, the *orang*, and the *gibbon*, or long-armed ape. They

¹ This nomenclature is distinctly popular. There is a good deal of discrepancy among the systems in use. The term *anthropoidea* is used by some to include man and all apes and monkeys. It might be more accurate to use the term *lemuroids* instead of *lemurs*, the latter being a species of the former, though the name *lemurs* is often applied to the whole; but the system I have used is allowable and the most convenient in popular parlance.

are all tailless, with a general resemblance to man. The two former live in Africa, the two latter in Asia. Then come the old-world monkeys, or *catarrhines*, then the new-world ones, or *platyrrhines*. Although they are widely separated at present it is generally taught that in very early times the arrangement of the continents was such that one of these groups might come from the other, or that they might both have sprung from a common stock. Lowest of all are the *lemurs*, small, monkey-like creatures, but with certain anatomical peculiarities which distinguish them (or almost all of them) very well from the monkeys. In German they are called *Halbaffen*, half-apes, rather a convenient term. Their headquarters, so to speak, are in Madagascar, but some are found in both Asia and Africa.

In this connection mention should be made also of the *Neanderthal* skull which was found some half century ago. Great has been the controversy concerning it; but probably the best authorities now look upon it as a very low-grade human skull. In 1895 Dr. Dubois found the Trinil bones, namely

part of a skull, a thigh-bone and some teeth. Though they were not found very near together they have been accepted as parts of one individual now known as *Pithecanthropus erectus*. The thigh-bone is remarkable as being extremely human. Some, however, maintain that it resembles the femur of the gibbon more closely than that of man. The skull is that of an ape higher than any now existing. Great efforts were made to have this animal figure as the long-wished-for missing link. The great antiquity once claimed for it is very doubtful.

There have been many and great changes of opinion among men of science since the first appearance of Hæckel's scheme of human descent which, beginning with the lemurs, ran through platyrrhines, catarrhines, and anthropoids up to man. With many this still holds good, without, however, its being implied that any of the anthropoid apes is necessarily in the line of descent. Not so many years ago Schwalbe rejected both the main divisions of the monkey tribe and brought man and the anthropoids from a common stem. The divergence he held

occurred long ago; for all the existing anthropoids have developed in a one-sided fashion adapted to tree life. The Trinil skeleton found in Java, which is the foundation for the *Pithecanthropus*, is an intermediate form, though not necessarily in the line of descent. It is interesting to learn that the very human characteristics of the thigh-bone were acquired first, together with the upright position, and that the less advanced modifications of the skull accompanying the developing brain came later. Higher than this comes our old friend of Neanderthal. It would be interesting to follow Kohlbrugge in his attacks on this system which he bases on the measurements of skulls. He says that the skull of *Pithecanthropus* in some respects resembles the chimpanzee and in others the gibbon, and that man resembles each of the three in some points more closely than he does the others. He compares Schwalbe's work to a pyramid balanced on its apex. Indeed Schwalbe himself admits (rather a damning admission) that the discovery of a new primate might upset the whole plan. Kohlbrugge owns,

however, that the importance of the skull of *Pithecanthropus* is not to be denied, as it shows that a race has existed nearer to man than that of the anthropoids.

When we turn to Schwalbe's remarks at the Darwin Memorial Meeting we do not find them quite in accord with the above. He scouts as unscientific a system of descent that ignores the monkeys and declares that a system of descent must "keep strictly to the nearest structural relationships." If this principle be recognized it will, he says, "be admitted that the doctrine of special descent upheld by Hæckel, and set forth in Darwin's *Descent of Man*, is still valid to-day." He considers *Pithecanthropus* the root of a branch from the anthropoid ape root which has led up to man. Yet Darwin excluded the new-world monkeys, as Schwalbe mentions in this same article, from the genealogical tree altogether.

Kollmann's views differ very radically from Schwalbe's. "The first races of mankind to appear were not those with flat foreheads and prominent supraorbital borders, but, on the contrary, those with high, well-

shaped skulls such as belong to the embryos of apes, to the pygmies and to the recent large races." It is needless to say that this is quite in disaccord with the more popular views, such as that of Hæckel. Kollmann starts from the fact that the head of a young ape is very much more like that of a child than the head of an old ape is like that of a man. He holds that the likeness of the skull of a very young ape to that of a man is so great that there must be a family relationship. He believes that some higher differentiation, some favorable variation, must occur in the body of the mother and so a somewhat higher skull is transmitted to the offspring and is perpetuated. Concerning which Kohlbrugge remarks that "thus the first men were developed, not from the adult, but from the embryonic forms of anthropoids whose more favorable form of skull they managed to preserve in further growth." Kollmann explains the evident resemblances in the bodies of man and anthropoids not by descent but by *convergence*, the principle of which much will be said elsewhere, by which similar organs appear in widely separated forms. He be-

lieves that the heads of anthropoids of the tertiary period were not as yet those of apes, but were nice round ones, such as are still found in ape-embryos. Schwalbe makes the telling criticism of these views of Kollmann that much the same thing might be said of the heads of embryonic animals in general that is said of those of apes, and that thus mammals might be said to have come from a more man-like ancestor.

Concerning the controversy between Schwalbe and Kollmann, our author makes a remark which is quite in accord with what has been said elsewhere in these pages concerning evolution. "Such weapons as Cænigenesis and Convergence are unfortunately so shaped that anyone can use them when they suit him, or throw them aside when they do not. They show, therefore, in the prettiest way the uncertainty even now of the construction of the theory of descent. As soon as we go into details it leaves us in the lurch; it was only while our knowledge was small that everything seemed to fit together in most beautiful order." Kohlbrugge describes quite amusingly in his

work how Kollmann, wanting to find some form between man and his primitive form (somewhat resembling the chimpanzee), turned to the dwarfs of the primeval African forests, and then, in his desire to find similar races in other parts of the globe, called races pygmies which, according to Kohlbrugge, did not deserve it. Starting with the idea that our proximal ancestors were not more than one metre high, he derives from the pygmies, white, black, and yellow, the progenitors of the present races, alleging that smaller forms precede the larger, to which has been retorted that there is no evidence of ancient pygmies, and that those of to-day stand in the same relation to man that little dogs do to large ones.

Returning to the old discussion as to which ape can boast of the closest resemblance to man, Kohlbrugge brings before us Aeby's forgotten book on the skull of man and apes. His measurements show that the form nearest to man among apes is the gibbon, or long-armed ape, but that the South American monkey *crystothrix* is nearer still. Aeby recognized what more modern

anatomists have forgotten or wilfully ignored: that any system of descent is inadequate which does not recognize that the type of man is not in any one organ, but in all the physical and psychological features. He declared that while we are far from having this universal knowledge, we have learned enough about the various parts of the body to make it impossible for us to sketch any plan of descent. "It almost seems as if every part had its own line of descent, different from that of others." This, I may say in passing, is alike true and important.

The side lights that we get from monkeys and lemurs are more confusing than illuminating. The South American monkeys are in some respects more primitive than the catarrhines, while in other respects they are more like men; and this is especially true of the fossil forms. Van den Broek would fill the gap with *ateles*, the genus including the spider monkeys; but Kohlbrugge insists rightly enough that this genus has no connection with catarrhines nor with the anthropoids. Still, on the other hand, he admits

that it is as justifiable to bring man down from *ateles* as from an anthropoid, or indeed to consider both as instances of "convergence" with man, and so to hold that his hypothetical ancestor was related to neither group. It might be reiterated in passing that this "convergence" business is a very ticklish one. We have been taught almost word for word that resemblance implies relationship, or almost predicates it; but according to this doctrine it has nothing to do with it whatever. What guide then is left to us? Kohlbrugge now introduces Haacke, who denies any relationship between man and apes, the latter being instances of one-sided development. He even dares to declare anyone who speaks of an intermediate form between man and apes to be ignorant of the laws of development governing the race history of mammals. He believes man came from some lemuroid form, which may have descended from the insectivora.

Hubrecht's scheme of descent is similar. First of all he eliminates the lemurs and next the catarrhines and anthropoids. He would

remove the little *tarsius* from among the lemurs (for which there seems to be good reason) and put him among the platyrrhines and then bring man from the insectivora, which with Huxley he holds to be the oldest mammals, down through the American monkeys, and especially *tarsius*. Before coming to *tarsius*, however, we have the fossil *anaptomorphus*, a small animal of the eocene period found in North America. It is true this has been classed with the lemurs; but it is of a more generalized type, and we may assume that it leads to *tarsius*, the two having many points of resemblance. This *anaptomorphus* is a most interesting creature. Like *tarsius*, its teeth have resemblances to those of the insectivora, and on the other hand the teeth of *anaptomorphus* resemble those of men. According to Cope, his dentition is "as far advanced in reduction as that of man." The relative size of the brain must have been great, larger than that of other mammals. Hubrecht as well as Klaatsch, of whom more later, makes light of the gradual assumption of the erect attitude. The latter says (Morph. Jahrbuch.,

1901, Bd. XXIX, s. 274): "Man and his ancestors were never quadrupeds as the dog, or the elephant, or the horse. The idea of a painful uplifting of the forward extremity by which the hand has been gradually acquired (*erworben*) is physiologically nonsense and philogenetically false." He considers the half-erect position an extremely old one which could very easily pass into the upright one in the primates, as it has in birds and dinosaurs. Yet how much have we been told of the far-reaching effects on the organism of this slow and painful acquisition of a radically new position! As an explanation it has been terribly overworked. To return to *tarsius*: Kohlbrugge looks upon his chance of being declared an ancestor of man as very good indeed, apart from the question as to whether he is to be reckoned a lemur or not. The answer, he says, depends on what structures are to be considered most important for classification, and that, he remarks, we think somewhat sarcastically, is wholly a matter of opinion. But then he recognizes that if we are going to talk about "convergence," *tarsius*, among lemurs, and

ateles, among South American monkeys, both resemble anthropoids.

Much space is given to the interesting speculations of Klaatsch, who in some matters follows the same line as Hubrecht. As far back as palæozoic times, a race of land vertebrates had complete primate-like characteristics in the extremities, with hands and feet composed of five rays, of which the first was opposable. Those forms which fly and swim shot off from the main group, which retained the climbing mode of life and rose higher in the scale only through its brain. Under the circumstances one can hardly expect any resemblances to beasts in fossil human remains. The *Pithecanthropus* is no ancestor, but a near relation of the long-armed ape. Klaatsch believes that more such anthropoids have existed, and that this one stood very near to the common root. The prehensile foot has been retained by the marsupials and lemurs as well as by the higher primates, and from it the human foot has been evolved. Kohlbrugge remarks on the similarity of this theory to one of Karl Snell, who, as far back as 1863, declared that

man came from no known form, because all were too specialized to be his ancestor, but directly from the primitive form of vertebrates, of which all other forms are side offshoots. Klaatsch calls the ancestors of the anthropoids more human in many respects than their representatives of to-day, and remarks that "the less an ape has changed from its original form, just so much the more human it appears." Kohlbrugge's paraphrase is that man comes from an original form much more like himself than any existing apes.

Just as Hubrecht despises the conventional evolutionary idea of the origin of the hand, so Klaatsch dismisses with contempt the old theory that the foot became what it is through efforts to rise on the hind legs. According to him it is changed from a prehensile into a supporting organ by climbing trees, as the Australians do to-day. In this connection it may be worth while to quote another anatomist, Alsberg, who closely follows Klaatsch in this matter. "When it is considered self-evident . . . that it is the upright carriage which has made the

human foot an organ of support, the train of thought seems rather blundering. Can the means by which the upright carriage first became possible have been itself derived from the upright carriage?" Kohlbrugge, while admitting this, declines for similar reasons to accept the tree-climbing explanation as more satisfactory.

In this connection Kohlbrugge remarks: "The line of descent of man thus receives on the other side of the primates a quite different form from its previous one. Such new hypotheses as those of Hubrecht and Klaatsch seem, therefore, fortunate for nature-philosophers, because evolution always failed us when we compared known forms in their details, and led us only to confusion. But if one works with such very distant hypothetical ancestors, one escapes much disillusioning." The discussion of what constitutes higher and lower races brings in many suggestive side issues. He quotes Ranke to the effect that "the series obtained from skulls of our own race from earliest childhood to the adult, represent not only all the individual variations of our race,

but also the modifications which are given as the most important racial features of the whole human race." Until now the Caucasians have coolly appropriated the highest position in the human race on the strength above all of the relatively large cranial portion of the skull, and the relatively small face together with the large brain that this implies. But Kohlbrugge insists that the Mongols have a greater cranial capacity than the Europeans, and that the same is true of the natives of Tierra del Fuego, probably of the Esquimaux, and certainly of the Canary Islanders. If we appeal to the relative size of face and skull we again come to grief. Indeed, even the brain by itself is not consoling. Kohlbrugge contends that it is hopeless to seek in it a criterion for the classification of races as higher and lower. He found to his surprise that the frontal lobes of Australian brains are richer in fissures than those of any other race. Klaatsch compares the bones of the highly placed Tasmanian with the lowly placed Australian, and decides that the time of a common ancestor must have been very remote. Then

following Kohlbrugge, one must assume either that this ancestral form was a very pithecoïd one from which the Tasmanian freed himself by a development parallel to that of the European, which was the former view, or the Tasmanian continues nearest to the original human-like form, which the Australian, developing ape-like features, has wandered from. The latter, according to our author, would be the new explanation, the logical carrying out of Klaatsch's principles. "In the same sense in which Klaatsch wrote, 'The more primitive an ape has remained, just so much more man-like is he,' so one should read here: 'The more primitive a Tasmanian has kept himself, the more European he is.' I believe the latter is as defensible as the former,—at the same time the Tasmanian, in the absence of the boomerang, seems intellectually lower than the Australian." (Kohlbrugge.)

We have heard only too much of the alleged repetition in the development of the embryo of that of the race; and for a long time we have known that at best the repetition is general and vague. Now comes

Van den Broek, and tells us (what is quite evident) that according to this we should expect ape-like features in the skull and pelvis of the human embryo. Yet we find the very reverse. The human embryonic skull does not show anthropoid characteristics, but the anthropoid embryo's skull shows human ones. It is the same with the pelvis.

Many curious observations might be made on what are called stigmata of degradation. Is not the prehensile toe an ape-like feature? Yet, as Kohlbrugge remarks, one would hardly dare in an anthropological congress held at Tokio to refer to it as a sign of inferiority.

We shall not follow our author into the slight digression into psychology which he has followed himself, though we quite agree with him that it discloses a very one-sided view of the question to treat it only morphologically, especially as it is in view of his psychological properties that we place man so high. He comments very justly on the despotism which announced that the way of evolution was known, and demanded that its claims be allowed, the originators thinking to scamper in seven-leagued boots over

ground which will require hundreds of years of the most earnest investigation. He hopes that "the above representation will certainly convince anyone who harbors such ideas that we really know nothing about the great problem of evolution, that we have not even seen its face." One puts down this book with a feeling of bewilderment, even those of us who belong to the craft. True, we knew it before; we knew that no theory would hold water; but yet even we are somewhat surprised when we have it thus made clear to us that of the various theories there is nothing even approximately certain, nor even approximately probable. What effect it will have on the gullible followers of the Hæckel school is beyond telling. Probably they will ignore it, or make light of it; precisely as spiritists do when the frauds of a medium are exposed. After all, it must be trying to see their leaders in this new light, "all wranglers and all wrong."

Since this review was written we have become indebted to Klaatsch¹ for a new

¹ *Zeitschrift für Ethnologie*, 1910.

prehistoric race, that of Aurignac, *founded on a single skeleton*, found in the Department of Dordogne in France, in 1909. He considers it allied to the orang, and shows at length that the Neanderthal race is allied to the gorilla. This is not saying that he derives either of these races from the apes they resemble, but he considers each race as coming from the same stem as the ape in question. He seems to imply that there may be even other races coming from the same stems as still other apes.

IX

VARIATIONS AND ANOMALIES

Synopsis.—Variation in the human shoulder-blade. Classifications of anomalies. Testut; Duval's preface to his work. The "strain" theory to explain bony prominences; its inadequacy to account for the third trochanter. Impossibility of describing certain anomalies as "reversions"; the third trochanter, the supracondyloid process, the paramastoid process, fossa prænalis, process for teres major. The ear. Similar variations in man and animals shown in a muscle above the wrist. Macalister's views; Huntington's, Wiedersheim's. Alleged progressive variations. Rosenberg's theory and its failure. Similarity of structure no proof of relationship.

A DEFINITION of variation is hardly necessary. It implies an increase or a decrease of any feature of any structure. A thigh-bone a little more bent, an ear a little more pointed, a nose a little more projecting, and so on indefinitely, a little more or a little less of anything you please—this is variation.

That the human body shows very great

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variation in certain parts is well enough known, but several years ago I happened to make an observation which seems to me very striking. The shoulder-blade has the function of supporting the arm at the shoulder and of affording leverage for muscles inserted into its various parts. It is easy to see, when we consider how very differently people are made in this region, that the shape of the bone should be very uncertain, and much more so than in animals with a less free use of the arm, in which consequently the bone has to fulfil only its primary purpose of supporting it. Thus in man I found not only a very great difference in the shape of the bone, but in analyzing the various parts of it there is a great difference in all of them. The whole bone may be long and narrow, or broad and short. The upper border may run in a number of different ways. The highest angle may be pointed or truncated; the border nearest to the spine may be nearly straight, or convex, or even concave. The lower angle may be round and blunt, or sharp, and so on. In short, I was able to construct a number of

series showing all degrees of variation of different parts, which are now in the Warren Museum of the Harvard Medical School. Of course I have not had access to the same amount of material for seeing how great is the range of variation in any animal, but taking at random, in the Society of Natural History, the shoulder-blade of a lion, of a panther and of a leopard, which represent three different species of the family of the *felidæ*, the cat tribe of the carnivora, I found that the bones in these three different species (excepting in the mere point of size) were much more alike than human bones taken from the white race, such as we find all about us. According to pure Darwinism, indefinite continuation of indefinite changes leads to great results, to nothing less than new species; but evidence of it has been lacking, unless, indeed, we follow Weismann's great rule of reasoning: that we must accept it because there is no other escape from admitting design.

An anatomical anomaly is some peculiarity of any part of the body which cannot be expressed in terms of more or less, but is

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distinctly new; that is to say, it is something that either does not belong to the adult animal in question under normal circumstances, or is at best quite insignificant.

Of the many ways of classifying anomalies, the one most in accord with dominant ideas is that of their relation to the supposed past or future. Thus, some would have anomalies divided into two great groups only—those which are reversionary, and those which are for the future. Others, like Ledouble, add a third class which at present they would hold distinct, namely absolutely irregular anomalies, the irregularity being that they do not fit into either of the preceding classes. This method is claimed as very scientific by its friends; but, after all, it is clear that it rests on a theory. What evidence is there that the body is undergoing metamorphosis? Another more truly scientific method is to divide anomalies as much as possible according to their nature: thus, those of repetition or suppression of one or more elements of a series, as when there are thirteen or eleven pairs of ribs; those dependent on a variation from the

usual course of development by the suppression of some structure of the embryo which usually persists, or by the persistence of some structure that usually disappears; those due to the fusion of parts usually distinct, or to the division of parts usually simple. These are all morphological changes; but there are also anomalies of tissue, in which a certain structure that is usually of one material is made of another, as when what is normally a cord is made of bone or of cartilage. All these subdivisions rest on a basis of fact; certain definite changes have unmistakably occurred, and there is no question of theory about it. All the above classes of anomalies may be further subdivided into such as reproduce a feature found in some animal and into those that do not. The former of these may be again subdivided into those in which the structure in question could be plausibly traced along some line of descent, and into those in which this is out of the question.

The study of variations and anomalies of the human body has been my favorite line of research for many years, and has perhaps

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done more than anything else to show me the futility of Darwinism as a means of accounting for anything; and further, that they must be accounted for by a law of which we know very little. Huxley was sharp-sighted enough to appreciate that variations might prove a two-edged sword to evolution. Not so the smaller fry. As a truly admirable instance of the sham science that passed current some thirty years ago, let me quote from the preface by Mathias Duval to Testut's work, *Les Anomalies musculaires de l'Homme expliquées par l'Anatomie comparée*, published in 1884. One might wish indeed that he would explain his explanation; but to return to Duval's preface: It is rather surprising to be told that the evolutionary idea came first of all from Lamarck, but this is nothing to its being "completely established" (save the mark) by Darwin. Let Duval speak for himself.

"The evolutionary doctrine so wonderfully inaugurated by Lamarck, so completely established by Darwin, has shown that individual variations group themselves into two orders

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of fact absolutely distinct both as to significance and origin, but obeying in common the laws of heredity and the transformation of species of which they are manifestations. In fact, of these two orders of variations, the one order is in some degree a step towards the future, that is to say, towards transformations yet to come, the other a return to the past, that is to say, towards the transformations already submitted. The former are progressive anomalies, the latter regressive ones. As for the former, we know with what strict demonstration Darwin has established the effect of the smallest individual variations, which, transmitted by heredity, developed and fixed by natural, as well as by artificial, selection, grow to become characteristics of varieties, of races, and finally of species. Under the modifying influence of surroundings, especially when this influence is exercised on embryonic phases, or by the effect of use or disuse of parts, a certain individual presents characteristics which differentiate him (sometimes in almost an imperceptible degree, to be sure) from his ancestors, and from his brothers. If the differential

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character is of advantage to him in the struggle for existence, this same advantage will belong to those of his descendants to whom he has transmitted it; and fixing and accentuating itself in these according to the laws of heredity and of selection, it will become from the simple variation that it was originally, a distinctive characteristic of a new race, and then of a new species. Hence, what was originally an anomaly, an individual variation, has become the dominant form, the rule, the characteristic."

That these statements are not confirmed by the investigations of science, and that much that is laid down here as absolute doctrine rests on exceedingly flimsy evidence, is something of which I need remind no thorough student of comparative anatomy, or of the other questions of the day. It is greatly to be regretted that teachings of this kind are accepted as certain by vast numbers who have not the opportunity for individual study. In fact, the whole book is a monumental example of misapplied research. To find an occasional form of a muscle in man that is normal, in no matter what animal,

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was apparently perfectly satisfactory and profoundly scientific. It was of no consequence to what species, order or class the animal might belong. In the case of the biceps alone were found instances of the arrangement peculiar to enough animals to stock a menagerie. The ornithorhynchus did just as well as an ape and the giraffe as a monkey; to find an instance of similarity was all that was required. How the peculiarity could have been transmitted to man was passed over.

In my earlier days of anatomy I thought in my innocence that I must be very ignorant, because I could not understand how the occasional appearance in man of a peculiarity of some animal outside of any conceivable line of descent could be called a reversion, as it soon became the custom to call it. I asked several men of science, and was surprised at the vagueness and want of conviction in their answers. It was not till later that I grasped the fact that the reason I could not understand these things was that there was nothing to understand. It was sham science from beginning to end.

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In those days some thought to explain the unusual development of certain prominences commonly found in bones, and the appearance of others not usually present, by the greater strain exerted by the muscles of the individual in question. This is so far correct that a great strain through a muscle or tendon generally occasions an increased prominence of the bone at the point of its attachment. But I found that this explanation was not of universal application, for exceptional prominences are met with not infrequently on decidedly delicate bones which show no signs of hard work. The so-called third trochanter, a prominence occasionally appearing at the upper end of the shaft of the thigh-bone, is a very interesting structure for more than one reason. "It is clearly impossible to prove, in the case of any third trochanter occurring in the adult, that there may not have been an excessive strain on the *gluteus maximus*" (a muscle) "according to the theory I am disputing; but such a strain must have been due to some particular occupation, and if therefore it can be shown that this process, or even great differences in the

degree of roughness, occur frequently in both sexes in prehistoric, in savage, and in but slightly civilized races, in which presumably all lived pretty much the same life, and especially if it occurs in very young persons, not old enough to have been subjected to long-continued strain, the theory becomes so highly improbable as to be untenable.”¹

With a view to settling this point, I examined skeletons at the Army Medical Museum and at the National Museum at Washington, at the Hunterian Museum in London, and particularly at the Peabody Museum of Harvard College, and showed conclusively that there was great variation among bones of the same prehistoric or savage races in this respect. Among my series I may mention that I examined both thigh-bones of seventy-four skeletons from the Tennessee stone graves, and found a true third trochanter on both sides in eight skeletons (one case being somewhat doubtful), and on a

¹ From a paper by the author: “The Significance of the Third Trochanter and of Similar Bony Processes in Man,” *The Journal of Anatomy and Physiology*, Vol. XXIV, 1889.

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single side only in two skeletons. There was no true third trochanter on either side in forty-four, nor on one side in two cases, the other side being doubtful. The other specimens presented ridges which might or might not be called third trochanters. This shows clearly how much variation there is in a savage race. More than this, "one of the skeletons, presenting on both sides a rough ridge leading into a probable third trochanter, is that of a child of about ten years; and another, of a person about eighteen, has a true third trochanter on one side only." At the Army Medical Museum I found the skeleton of a Sioux Indian girl of about thirteen with an excellent third trochanter on both sides. "These individuals were too young to have acquired the bony projection by the pull of a muscle."

Other observations led to similar results, which justified me in stating that "in wild and in but slightly civilized races there are great discrepancies between different individuals." The young specimens disprove conclusively the "strain" theory as a general cause. It is also noteworthy that the pro-

jection was absent on many large and strong bones.

How then are we to account for the appearance of this knob, known as the third trochanter, in the cases to which the "strain" theory, which to a certain extent is correct, does not apply? There is no question that it represents a feature normal in certain animals, which too often is called a "reversion," but might more properly be called an animal analogy, and which clearly must be in accordance with some law. There are many instances of such anomalies. I showed long ago that the popular theory of reversion was untenable.¹ For this discussion I selected three structures very widely distributed in the animal kingdom, which frequently appear as anomalies in man's skeleton, namely: the supracondyloid process of the humerus, the third trochanter of the thigh-bone, and the paramastoid process, a projection from the base of the skull, near the mastoid process, which is the prominence easily felt behind and below the ear. A

¹ "The Significance of Anomalies," *The American Naturalist*, February, 1895.

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word of explanation about the supracondyloid process is perhaps necessary. The internal condyle of the humerus is the point just above the elbow-joint at the inner side. It is easily recognized in the living. Now in certain animals, just above this projection there is a hole in the bone through which passes a certain important nerve. In man there is occasionally found a projection from the shaft from which a band of fibrous tissue runs to the condyle, making an arch which corresponds to the boundary of the hole in the bone in lower forms. I have had the good fortune to obtain a specimen in which this arch is bone, and thus more closely resembling the animal form, but I incline to believe the case is unique. What is usually found is a more or less prominent spike of bone called the supracondyloid process. The occurrence in man of a third trochanter is very common, that of a supracondyloid process, of which normally there is not the slightest trace in man, very uncommon, though it is the most widely spread among animals, and a large paramastoid process, a projection which normally is wanting or very minute, a great rarity.

Of these three anomalies, the supracondyloid process is the most interesting, and from an evolutionary standpoint the most satisfactory. It may plausibly be argued that it is occasionally inherited from a very ancient form. It is found very widely distributed throughout many orders of mammals, though by no means in all species. It is curious, by the way, that among the carnivora it is normal in the cat tribe, the tigers and lions, and not among the dogs, wolves and hyenas. It is found, however, below mammals both in some of the reptiles and some of the amphibians. It is found among none of the higher apes, but in some of the monkeys. It has one characteristic of an atavistic structure, namely that its appearance in man is very rare. The books say that it is found two or three times in one hundred; but my experience, running over many years, would make it much rarer.

The paramastoid process occasionally appears in man. Giebel writes: "The lateral edge (of the exoccipital) from which it springs is rounded off and does not project in most apes, in insectivora, in particular

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carnivora and marsupialia, a few rodents and edentata, in monotremes and cetaceans. In others it projects a little; and in many others among carnivora and marsupialia, rodents, and all ungulata, it is developed as a long process." It is long and slender in the bats; very large in Babirusa of the swine family, and in Capybara of the rodents. It shows every degree of development in nearly allied species.

The third trochanter is almost universal among the lemuroids as a rudiment, and in some species reaches a moderate development. There are traces of it among the smaller monkeys, and it is occasionally found in the gibbons and in the chimpanzee. A very curious fact is its immense development in the odd-toed ungulates, such as the horse, the rhinoceros and the tapir, and its absence in the even-toed ones, such as the ox and the sheep.

Now it is evident, if we are to account for these anomalies in man on the plea of reversion, that ancestors of man must have had not only one of these three features, but all of them. Let us see how the case stands. None of these features occur normally in the

anthropoid apes. This is of no great importance, for according to the most generally accepted theory man's body and that of the anthropoid apes have a common origin. The supracondyloid foramen is practically universal among the lemuroids, while among the monkeys it is limited to the *cebidae*, a family of the new world. The third trochanter is almost universal among the lemuroids and in some species reaches a moderate development. There are traces of it in some of the smaller monkeys. I am not aware that the paramastoid process is ever found in a more than rudimentary condition among the primates. If we were justified in making the primates spring from the insectivora it would help a little, for several genera among them have a well-developed paramastoid process, the supracondyloid process in general, and the third trochanter is frequently found, though it is neither very common nor very well developed. To find it well developed in the horse is the reverse of explanatory. The more anomalies we study, the less justification do we find for explaining them as reversions.

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The border at the lower opening of the cavity of the nose is usually in the human skull a sharp little ridge. In animals the lower border is as a rule rounded off so that there is no sharp distinction between the inside of the nose and the front of the face. Occasionally in low human skulls this condition is found, and it is not absurd to call it a reversion; but very rarely there exists just below the entrance of the nose a little pit with sharply marked borders entirely different from the gutter-like form, called the *fossa prænasalis*. I have sought for this feature very carefully among the skulls of mammals without success, except in the seal tribe.¹ There I have found it variously developed and sometimes very well marked, notably in the harp seal; but I have not been able to study a large enough series to be sure that it is quite constant. I incline strongly, however, to believe that it may be said to be normal in this aberrant family of the carnivora. Will someone kindly tell me how man has reverted to the seal?

¹ "Fossa Prænasalis," *The American Journal of the Medical Sciences*, February, 1892.

There is normally in the human shoulder-blade a little projection from the lower part of the front border which gives origin to a part of a shoulder muscle, the *teres major*. Now this may be greater or smaller in different bones, and it is but natural to expect to find it larger in stronger bones, from which powerful muscles spring. But occasionally this little prominence is drawn out into a considerable projection. Naturally many would say that this is to give support to a stronger muscle; but it is a fact that in many cases in which it is best marked the bone is a very delicate one. We look for it in vain among the higher apes, but there are hints of it in mammals of various orders, and it is particularly developed in some of the smaller monkeys. Among savage races I have found it very differently developed in different individuals of the same tribe, and also well marked in some of the weaker bones. The same line of argument applies to this as to the third trochanter. It is not to be explained by strain, nor by descent; yet there it is, and there must be an explanation.

I am sometimes at a loss to understand

why so much talk has been made about "Darwin's tubercle" of the ear, to which his attention was called by Woolner, who had been working on the ear of a fawn. It is easy enough to see that it represents the real point or apex of the ear, if we unfold it and compare it, for instance, with that of a deer. We are told that in most cases the human ear resembles that of the *macacus*, and occasionally that of the *cercopithecus*, both of which are monkeys, and presumably not in line of descent. Even if one should be the other is not, for it is not at all probable that one is above the other. Moreover, it is taught that in comparatively early embryonic life the human ear has certain structures for support which are normal in some animals, as the ox and the pig, which shortly disappear. Man's ear is apparently in a retrograde condition, with merely rudimentary muscles which only exceptionally have any function; yet the ear of the orang is in even a worse case. For my part I see plenty of evidence for a common plan of the human and animal ear, or rather, it seems to me self-evident that such is the case; but

how does the ear have any claim to appear as a witness for descent?

But when we go into the study of the muscular system, which presents variations without end, the trouble of making them agree with any line of descent is increased indefinitely. The following observation is, I think, a very curious one. The *pronator quadratus* is a small, squarish muscle placed deep in the forearm beneath the tendons running through the palm of the hand and just above the wrist. It gets its name from its supposed function of turning the hand over so as to make it prone with the back upward, and from its shape. Very rarely it sends a prolongation down to one of the bones of the wrist. I am not aware that this condition is normal in any animal, though Testut would have it correspond to a muscle found in a Japanese salamander, *cryptobranchus Japonicus*, and to one described by Meckel in turtles. Now I found this form of the muscle in both arms of a chimpanzee, and Macalister observed it once in a tiger, though it is normal in neither. Thus, these animals vary in the same way

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as man. Does either of them come from the salamander or turtle? Professor Wiedersheim,¹ whom one would hesitate to call conservative, declares that Testut and Le Double have gone much too far.

Professor Macalister² of Cambridge, the great authority in England on anatomical variations, showed himself opposed to the popular views. "I cannot see that when one finds in the limb of a kangaroo or of a sloth, or in the face of a horse, a certain form of muscle like one which occurs as an anomaly in man, we must therefore conclude that its human occurrence must necessarily be due to atavism. Indeed, the more I survey the catalogue of such parts the more I am impressed with the failure of the method as a scientific mode of accounting for these anomalies, while at the same time I am filled with admiration at the industry and ingenuity with which the process of matching has been carried on." To this must be added that the increasing study by which

¹ *Der Bau des Menschen als Zeugnis für seine Vergangenheit.* (The Structure of Man as Evidence of His Past, 1908.)

² Robert Boyle Lecture, 1894.

more and more such anomalies, which I would call animal variations, are brought to light only increases the difficulty; for this theory demands that every one of these variations must be brought into the direct line of descent. Phylogeny must show nothing in the history of the ancestry of any single anomaly which will not agree with that of every other one; and it does nothing of the kind. It is not worth while, even for the sake of a laugh, to discuss at length the absurdities written in trying to do the impossible, but I will refer to a single one as typical of a class. A medical writer on the vermiform appendix, after stating that it is to be considered the end of the cæcum, went on to remark that the double appendixes which are said to have occurred (I never saw one) are presumably to be explained by the double cæca found in birds. One can only exclaim with Mr. C. J. Yellowplush: "Igsplane this, men and angels!"

Professor George S. Huntington,¹ who has studied variations very deeply, distinguishes

¹ *The American Journal of Anatomy*, Vol. II, p. 157, 1903.

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three kinds: archeal reversionary variations reproducing conditions not found among the mammals, but which seem to be homologous with structures in other vertebrates, which therefore he carries back to a common vertebrate type (quite a hypothetical one, by the way), which existed before the classes of fishes, amphibians, reptiles, birds and mammals had sprouted off from it. Then he names two other more modern, less far-reaching, groups of variations which need not concern us now. But the difficulty of accounting for a variation is not lessened by calling it archeal; indeed, the further we carry it back the greater is the gulf to be cleared, and the more impossible the leap. Finally, by so doing we are guilty of the absurdity of making the lowest forms, from which all other vertebrates have sprung, perfect museums of anatomical curios in direct defiance of the primary laws of evolution in accordance with which the simple precedes the complex. Professor Huntington evidently recognized this, as appears from the following quotation:

“The fact that in case of any given human

muscular variation a muscle of similar character is found in one of the lower vertebrates does not warrant the assumption that both are derived by inheritance from an immediately precedent common ancestral form. The form in which the variant human muscle appears normally may be incalculably far removed from man, may even belong to a different vertebrate class. That the structural coincidence of the two muscles is to be taken as indicating anything more than the most generalized relationship of vertebrates is difficult to believe. For many of the aberrant muscular conditions observed in man a very comprehensive view as to their derivation must be adopted. I believe that we are right in referring such variations to the development of an inherent constructive type, abnormal for the species in question, but revealing its morphological significance and value by appearing as the normal condition in other vertebrates."

There is, in justice to what I may call the "reversion" view, one other aspect of it which should receive some attention. It is the one hinted at in Wiedersheim's popular

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work. Its supporters would say that although it is out of the question to trace all the occasional anomalies of structure in man down any line of descent, yet that general characters wide-spread among animals are to be found more or less generally in man, especially in his embryonic condition. Thus that the early hairiness indicates the condition common to mammals need not be disputed, whether or not we are prepared to see indications of scales throughout the skin as Wiedersheim would have us. The normal presence of the *platysma myoides*, the subcutaneous muscle of the neck, as well as its occasional abnormal development, and the appearance of muscular fibres under the skin in other places, all point to the general presence of such a layer. It is simply silly to claim to derive it from animals like the hedgehog, in which it is wonderfully developed; it is enough to say that among mammals it is general, and so on indefinitely throughout the old story of rudimentary organs and of structures like the functionless gills of the human embryo, all of which we are told are inherited. But do these

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indeed testify for descent? Why so more than for a common plan? It seems to me that the latter of these explanations is more logical than the former and better in accord with facts. But when we come to details of structure the difficulty increases. It is well enough to say that certain muscles are remnants of layers which covered most of the bodies of our ancestors; but when certain occasional forms of them reproduce what is normal in certain apes (for instance), our witness becomes one of those abominated by lawyers, who volunteer information that was neither asked for nor wanted. Thus, if this skin muscle shows in a certain man a close resemblance to the condition in a certain ape, something more than the general explanation is called for. Man never came from that ape; why, then, are they alike? Have they any common ancestor with this peculiarity? If none can be produced, something besides reversion, even of only general features, must be called upon to account for this special resemblance, and again we are groping for a common plan, a common law of development of which we see the neces-

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sity, but of which we do not grasp the details. This should be enough to dispose of the popular idea that all the animal peculiarities occasionally appearing in man can be accounted for by descent.

Let us now glance at the alleged progressive or prophetic variations which, according to the theory, are steps towards future changes. I am unwilling to spend much time on this, for not only is the evidence of any such process worthless, but the discussion involves an accurate knowledge of anatomy which I do not expect from my readers. The most common examples of alleged progressive changes are taken from the human spine. I regret that for the reason just given a thorough discussion seems out of place here. Suffice it to say that the claim of such changes rests chiefly on the system of Rosenberg,¹ announced some forty years ago. He thought he had discovered that in the very young human embryo the bone which is to form the pelvis and which bears the thigh-bone, is placed opposite the rudiment of a vertebra further from the

¹ *Morphologisches Jahrbuch*, Bd. I, 1876.

head than the one it actually joins. Thus it shifts its position during development. Now as most mammals have more vertebræ in the back and loins than man has (the number in the neck being practically always seven), it is very pretty to show how, in travelling forward along the spine, the future pelvis repeats in the individual what has taken place in the race. If by any chance it should stop too soon, why, it shows a reversion; if on the other hand it should go too far, thus leaving fewer vertebræ than usual between the head and the pelvis, why, it is a step towards the future. Similar or rather analogous changes in the development of ribs exist at the root of the neck, and we are told that man's thorax is in process of losing some of its vertebræ. Shortly after the appearance of Rosenberg's first paper, Holl¹ of Innsbruck, an excellent anatomist, questioned the correctness of his observations and denied that the pelvis travels backwards (or tailwards) during development; but his contention was disregarded. Rosenberg's

¹ Sitzungsberichte Akad. Wissenschaften. Wien. Math. Nat. Classe 85, p. 181, 1882.

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theory was so perfectly in accord with fashionable theories that it came to be accepted almost as a dogma of science; but a few years ago Professor Bardeen¹ contradicted his facts, showing that instead of travelling forward the first appearance of the pelvis is nearer the head than its permanent one, and that very early indeed in development the vertebræ of the back present perfectly characteristic features. And this is the end of this very pretty but untenable theory which has been preached as gospel for a generation or more. My observations carried on for many years on numerical variation of the human spine have convinced me that we must accept the conclusion that they are merely variations round a mean, which for want of a better word we must call accidental, and which have no evolutionary significance. While certain variations may be plausibly explained as representing a previous condition, it is the wildest romance to represent any of them as giving a hint of the future.

Thus it is certain that animal features of

¹ *American Journal of Anatomy*, Vol. IV, 1905.

the most diverse kinds appear in man apparently without rhyme or reason, and also that they appear in precisely the same way in animals far removed from those in which they are normal. It is hopeless to try to account for them by inheritance; and to call them instances of convergence does not help matters. The following is the continuation of the last quotation from Professor Huntington: "I believe that we are right in referring such variations to the development of an inherent constructive type, abnormal for the species in question, but revealing its morphological significance and value by appearing as the normal condition in other vertebrates." It will not do to analyze this too closely in search of a clear-cut idea; but it shows plainly enough that the author assumes that there is a law governing these things and that a blind chance does not rule. My own conclusions from the study already referred to were as follows: "First, similarity of structure, either in the ordinary animal or in the one showing variations, is not necessarily a proof of descent. Second, those very irregularities which we

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call abnormal point to a law in accordance with which very diverse animals have a tendency to develop according to a common plan. This, be it noted, in no way denies the possible influence of surroundings.”¹

¹ *The American Naturalist*, February, 1895.

X

ADAPTATIONS

Synopsis.—Similar structures in very diverse animals. Instances. The origin of the eye. Similarities in terminal twigs of the evolutionary tree. Convergence. A purposeless evolution cannot account for it. Analogies to convergence in other fields. An internal directing force is essential.

No very deep knowledge of comparative anatomy is needed for us to know that very similar adaptations for particular purposes are found in very diverse animals. The curious low-grade mammal, the *ornithorhynchus*, with a hairy coat and the bill of a duck, is a familiar instance. We all know that the whales have the general form of the fish, although they are mammals, and going more into details, we know that the whale's flipper is on the same general plan as that of the old fossil saurians. The prevailing opinion is, or has been, that this is the primitive form from which the arms of vertebrates have developed, but careful analysis has not

found this quite satisfactory; in fact, it has been condemned by Krause in V. Bardeleben's great hand-book on human anatomy.

Mr. Dobson¹ gave long ago a very interesting account (but unfortunately too technical for discussion here) of the muscles of the leg of the so-called Pyrenean "water mole," which really is not a mole at all but one of the insectivora which resemble very closely the arrangement in the true moles, and he describes a precisely similar arrangement in the South American rodent, the *Bathyergus maritimus*. "How happens it," he asks, "that in certain widely separated species, in no way connected by descent from a common ancestor having similar peculiarities, separation of this tendon (the tibial flexor) from that of the fibular flexor and attachment to a different part of the foot, has occurred in a perfectly similar manner?" The only suggestion that he can make is that, the arrangement in question being the best, it has been reached independently by natural selection. But one may ask, "What happened to the long series

¹ *Journal of Anatomy and Physiology*, Vol. XIX, p. 20.

during centuries of centuries while this desirable transformation was in process?" The doctrine of chances alone is fatal to the theory. But more remarkable still is the similarity, pointed out by T. H. Morgan, of the first pair of legs of the mole-cricket, which is not even a vertebrate, with those of the mole. "By their use the mole-cricket makes a burrow near the surface of the ground, similar to, but of course much smaller than, that made by the mole. In both of these cases the adaptation is the more obvious, because, while the leg of the mole is formed on the same general plan as that of other vertebrates, and the leg of the mole-cricket has the same fundamental structure as that of other insects, yet in both cases the details of structure and the general proportions have been so altered that the leg is fitted for entirely different purposes from those to which the legs of other vertebrates and other insects are put." Father Wasmann has shown how the insects which are the guests of certain ants show such diverse features that it is hardly possible to tell to which order of insects they

belong, and that some even resemble mammals.

The origin of the eye, according to evolutionary doctrines, has been a very difficult problem, which gets worse rather than better the more you do for it. Even if we could persuade ourselves that certain cells blundered along by the lucky mating of individuals in whom they were a bit better developed than in others till they came to form a most complicated organ of sight, it would be a sufficient tax on our credulity to believe that this could come off successfully in some one extraordinarily lucky species; but that it should have turned out so well with all kinds of vertebrates is really too much to ask us to swallow. But this is not all: eyes are very widely spread among different classes of invertebrates. More wonderful still, the eyes of certain molluscs and crustacea are on stalks, and this is found also in various and very different families of fishes. How did this happen? Was it by descent from the molluscs or the crustacea? If not, how could chance have brought about such a similar result in diverse forms?

Now my argument is not that these things have not been evolved; for I think it much more probable that they have been, but that the evolution through which they came to their present perfection cannot have been, as according to Darwinism, a system of blind chance. There must have been in the developing organisms a living impulse to change for a special end, and also in a certain prescribed manner. How much this changing may have been modified by surroundings, or hampered by accident, is beyond saying, but the fact remains that, putting special creation aside, these similar adaptations can have been caused only by an internal purposeful impulse acting according to law. Moreover, it must have acted quickly, for half-made organs are not worth much, and the various species must have come to grief long before the organs passed through an evolution marked by minute changes.

Our study of variations and anomalies has shown that it is impossible to trace out any line of human descent by following their vagaries. We are not more fortunate when,

ascending the evolutionary tree, we find similar adaptations at the last twigs of diverging branches, and try to account for them by any theory that denies design. To be sure, we may speak of the law of "convergence," but the name does us no good, unless by showing that these occurrences are admitted, as in fact they must be.

Probably a careful study would show us many examples of this interesting phenomenon in various fields. Thus there is the "likeness of reason in animals," which St. Thomas referred to. Is not the parrot's power of talking another instance? The power of repair in crystals is another, being very suggestive of the action of the vital principle. There is at least one very curious instance in language. "Wick" and "wicked" are two words very much alike, yet of quite different derivation; now precisely the same is true of the French words "mèche" and "méchant." I have been told that it is true also of the two words having the same meanings in some far-Eastern dialect spoken, I believe, in Korea. But these last instances, which might be called fanciful, are quite

unnecessary to strengthen the argument offered by the observations of convergence in morphology alone. They show clearly enough the action of an internal directing force: the vital principle. They show convincingly that a system based on blind chance and without a goal is too weak to discuss. Were there no other arguments there would be enough to dispose of any system of evolution without God.

CONCLUSION

LET us look back and see on which side is the evidence of reason and of science. I have declared that the existence of God can be proved by strong arguments founded on reason alone which are held as adequate by the greatest intellects. Unfortunately there are men of fine minds who do not accept them. After all, there is a great difference between the agnostic who says he does not know, and the scientific anarchist who boasts that he *does* know that there is no God. As he cannot prove a negative, one may ask by what kind of authority is he justified in calling upon us to bow down and accept an unproved and unprovable dogma of his own making. By what law of reason are we to accept a system which is necessarily causeless? The existence of God can be proved by reason alone, but a causeless system is not only contrary to reason but beneath it. Which side is it here which savors of super-

stitution, of the enslavement of the will, and of the subjection of reason to authority?

Because there is a Creator, there must be plan and design. Admitting that what seems a wonderfully perfect plan may have been the work of chance alone, yet the existence of a vast number of such plans makes the suggestion absurd. We see plan both in the organic and the lifeless world. The more we know of the laws and arrangement of the elements and of their combinations, as well as of the stars and planets, just so much the more clearly is law apparent.

Turning to organisms, we cannot refuse the evidence of some system, perhaps of more than one system, of evolution; and yet, with the possible exception of evolution by sudden changes, there is no system that has stood the test. There is no even plausible line of ascent up to the body of man. Science shows us that whatsoever in evolution can be considered as established rests primarily on the action of an internal force. All that we know of evolution points to law. We see the phenomena of very similar organs, well called adaptations, as the terminal twigs of

